

THE PLANTS OF SANTA BARBARA ISLAND, CALIFORNIA¹

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Santa Barbara Island is one of the smallest of the California off-shore islands. It has an area of only 2.6 square kilometers or one square statute mile. Located southwest of Los Angeles, it is 61 kilometers (38 miles) from the nearest point on the California mainland, and 39 kilometers (24 miles) from the nearest island, Santa Catalina (fig. 1). Contrary to several local maps, Santa Barbara Island is in Santa Barbara County (California Government Code, section 23142).

The island is roughly triangular in outline (figs. 2-3). Most of its shoreline is extremely precipitous. There are no sandy beaches, and the few narrow rocky beaches are mostly submerged at high tide. The major portion of the island is composed of gradually undulating slopes flanking a low north-south oriented ridge that connects Signal Peak and North Peak, two small rounded hills with elevations of 193 and 171 meters respectively. Both to the east and west of the ridge are broad sea-formed terraces that extend nearly to the shore. The lower part of the eastern slope is cut by several small gullies. A short distance off the southwest shore is the islet of Sutil, which rises abruptly to a narrow irregular ridge with a maximum elevation of 91 meters. Shag Rock, off the northerly shore, and an unnamed rock just west of Webster Point are both high enough out of the water to support a few plant species; however, neither of these latter two is known to have been botanically collected.

The soil of Santa Barbara Island is thin and coarse at the most windy locations, while on the terraces it is deep, fine, friable, and fertile. Extreme temperatures of 34.5° C (94° F) and 4° C (39° F) have been reported; but the average temperature varies only slightly throughout the year, and the overall climate is remarkably equitable (Dunkle, 1950, pp. 273, 348, 355). Both temperature and soil are strongly influenced by wind which averages more than 27 kilometers per hour (16.8 mph) at exposed sites and about 12.6 kilometers per hour (7.8 mph) at sheltered sites (Dunkle, 1950, pp. 273-274, 349). The prevailing wind is from the west-northwest.

An annual rainfall of roughly 30.5 cm (12 inches) is supplemented by high relative humidity (Dunkle, 1950, pp. 255, 274-275, 353, 355). Nearly all of the rain comes between October and April, but wet fogs

¹ Publication of this paper subsidized by the Santa Barbara Botanic Garden.

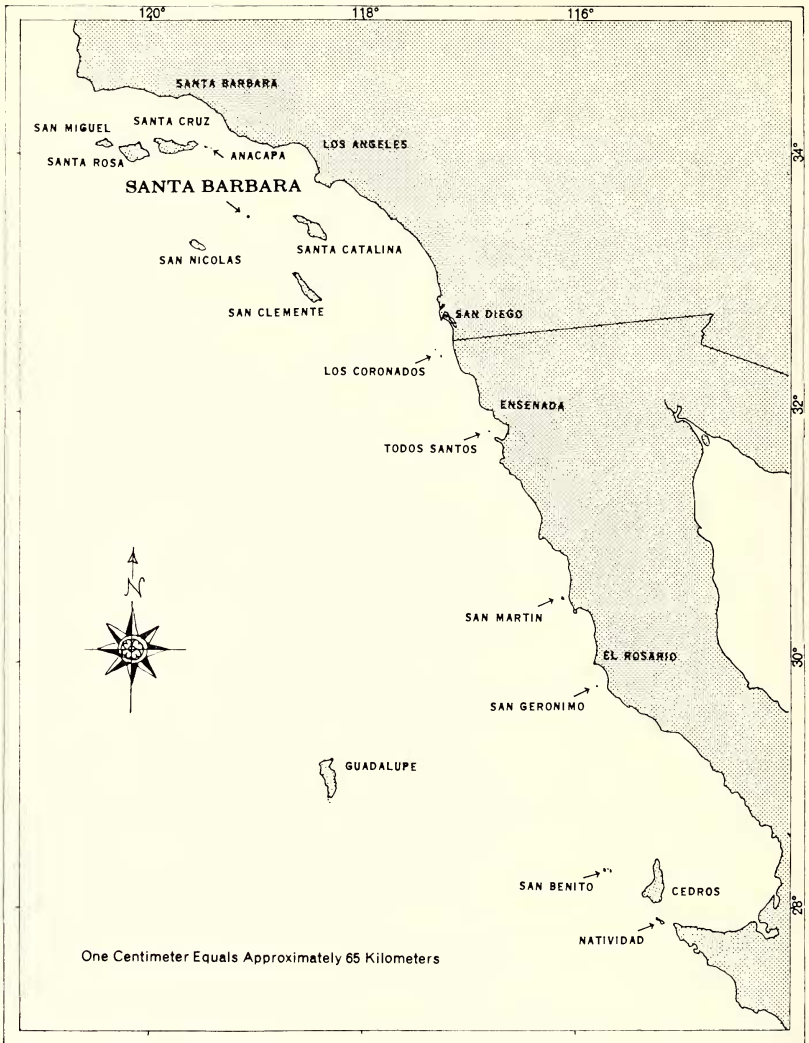


FIG. 1. California off-shore islands.

are frequent during the non-rainy months. Although very small temporary seeps have been reported at various times (Britton, 1897, p. 193; Dunkle, 1950, p. 270; Sumner, 1958, p. 3), there is no permanent fresh water on the island.

In the late winter and early spring most of Santa Barbara Island is covered with a luxuriant growth of suffrutescent and herbaceous plants. During the dry season the island looks bare and grayish brown. Grassland, iceplant, maritime-shrub, and sea-bluff plant communities are the most conspicuous components of the vegetation while woodland, chap-

arral, riparian, and beach communities are totally lacking. Introduced grasses and introduced iceplant occupy major portions of the slopes and terraces, thus suggesting the effects of man's activities on this island. At present most of the taxonomically important plants are relatively restricted. There are no trees on the island, and the shrubby vegetation is confined to scattered patches.

The native land animals include an insular endemic night-lizard that also occurs on San Nicolas and San Clemente islands, a small bat, and an endemic deer mouse found only on Santa Barbara Island (Savage, 1967; von Bloeker, 1967). California sea lions and a few northern elephant seals frequent the shore wherever it is low enough to provide them access (Bartholomew, 1967). Harbor seals are seen occasionally.

At least 70 different birds have been reported for Santa Barbara Island (Howell, 1917; Sumner & Bond, 1939; Grinnell & Miller, 1944; J. M. Diamond, personal communication, 1970). These include such interesting species and subspecies as the California brown pelican, Baird's pelagic cormorant, peregrine falcon, North American sparrow hawk, black oystercatcher, American pigeon guillemot, northern Xantus' murrelet, northern Cassin's auklet, North American barn owl, western burrowing owl, Costa's hummingbird, Allen's hummingbird, island horned lark, northern rock wren, dusky orange-crowned warbler, western meadowlark, San Clemente house finch, and the endemic Santa Barbara Island song sparrow. (Evaluations of available ornithological lists were provided by Alice I. Richardson and M. R. Benedict, personal communications, 1970).

Within the total of 70 birds reported, no more than 42 were listed in a single paper (Howell, 1917); and even this lower figure is a compilation based on observations over several years. Ten of the land bird species listed in 1917 were actually breeding on the island. By 1968 this number was reduced to six, not only the lowest figure for any of the islands from San Miguel to Los Coronados, but also the only one to show a net decline since 1917 (Diamond, 1969). In addition, the rate of turnover for breeding land bird species was higher than for any other of the above mentioned islands; and unfortunately the endemic song sparrow is now apparently extinct (J. M. Diamond, personal communication, 1970).

A preliminary study of the geology was made by Kemitzer (1933). He described the island as being composed of two types of volcanic rock separated by a thin whitish foraminiferous zone. The present island was probably the north slope of a Miocene volcano (Emery, 1960, p. 66).

Valentine and Lipps (1967, pp. 30-31) suggested that Santa Barbara Island appeared sometime between 2 and 11 million years ago. They indicated that submarine ridges, possibly including islands near the present-day sites of San Clemente, Santa Catalina, and San Nicolas, were less than 15 kilometers from a similar submarine ridge including Santa Barbara Island, which in turn was connected to the northern

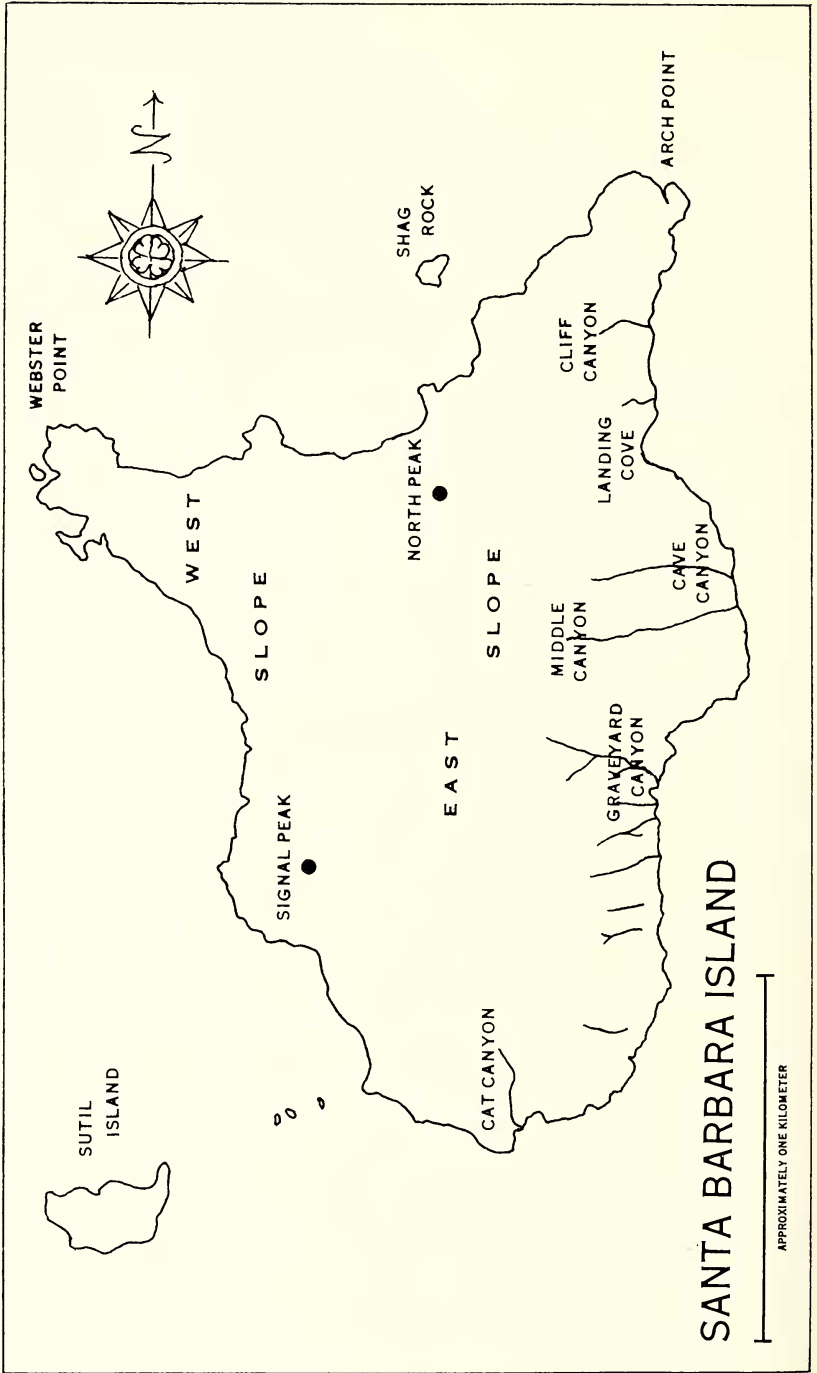


FIG. 2. Principal landmarks on Santa Barbara Island.



U.S. Department of Agriculture Photograph

FIG. 3. Aerial photograph of Santa Barbara Island.

islands. Corey (1954, p. 81), on the other hand, emphasized the possibility that Santa Barbara and Santa Catalina islands actually may have been connected during the Pliocene and that this combined land mass was quite close to San Clemente, San Nicolas, and the northern islands.

In any event, Santa Barbara Island was submerged during the late Pliocene or early Pleistocene (Valentine & Lipps, 1967, p. 30; J. H. Lipps, personal communication, 1970); thus the pertinent floristic history of this island probably begins only a few hundred thousand years ago. The terraces documented by Lipps, Valentine, and Mitchell (1968, pp. 292–294) indicate that subsequent repeated fluctuations of relative sea level restricted and expanded the size of the island during middle and late Pleistocene.

THE FLORA

In spite of its small size, isolation, uniform topography, and recent submergence, this island has a vascular flora of approximately 96 taxa in 75 genera. The best represented of the 32 families involved are Gramineae and Compositae with 18 species known for each. None of the genera are represented by a large number of species; the most for any one genus is five for *Bromus*. Many of the plants of Santa Barbara Island are widely distributed throughout much of California. On the other hand, *Lupinus*, *Rhus*, and *Haplopappus*, ubiquitous genera with wide-ranging species, are conspicuously absent from the island. The largest shrubby plants are *Eriogonum giganteum* var. *compactum*, three species of *Opuntia*, *Artemisia californica* var. *insularis*, *Baccharis pilularis* subsp. *consanguinea*, and *Coreopsis gigantea*.

The current knowledge of the plants of this island is based, in large part, on the herbarium specimens and other records of the following collectors:

- James G. Cooper¹—May 1863
- William G. W. Harford and/or Albert Kellogg²—about 1871
- Blanche Trask—May 1901, May 1902
- Robert E. Snodgrass—August 1901
- Henry Hemphill¹—date uncertain
- Barton W. Evermann—March 1918
- LeRoy Abrams and Ira L. Wiggins—July 1931
- Norman E. Bilderback—April 1938
- Francis H. Elmore—August 1938
- Richard M. Bond—April 1939, May 1940

¹ J. G. Cooper collected only a single known specimen, which is discussed in the plant list under *Galvezia*. The only known Hemphill specimen from Santa Barbara Island is of *Camissonia*; this was collected before September 1927, probably about

- Meryl B. Dunkle—May 1939, March 1940, September 1941
 George P. Kanakoff¹—August 1940
 Reid Moran—April-May 1941, February 1949
 E. R. Blakley—October 1961, May 1963
 Martin A. Piehl—May 1963
 Ralph N. Philbrick—June 1964, March 1968, April 1969,
 February 1970
 Ralph N. Philbrick and Michael R. Benedict—May 1966,
 March 1970
 Ralph N. Philbrick, James K. McPherson, and Robert F.
 Thorne—April 1968
 Ralph N. Philbrick and Donald W. Ricker—March 1969

The dates of these collections span the years from 1863 through the present; most of the earlier collections were made during the late 1930's and early 1940's at the time of the Channel Islands Biological Survey, organized by the Los Angeles County Museum. The extensive collections of M. B. Dunkle provide the major basis for comparison with today's flora of Santa Barbara Island.

INTRODUCED PLANTS

Twenty-eight species, or approximately 29 percent of the Santa Barbara Island flora, are presumed to have been introduced to California during historic time (modified from Munz, 1959 & 1968); this includes a total of 10 grasses. Nearly all of these same introduced species are shared with each of the other California islands for which comparable data are available, i.e., 22 species shared with San Miguel, 23 with San Nicolas, 27 with Santa Catalina, and 25 with San Clemente.

The overall percentages of introduced plants for these four islands range from about 35 percent for San Nicolas (modified from Foreman, 1967) to about 22 percent for San Clemente (modified from Raven, 1963, and Thorne, 1969). In contrast the floras of other floristically related islands contain an even smaller proportion of introduced plants. Guadalupe has about 42 introduced taxa, which comprise 20 percent of its flora; and Cedros has about 22 introduced taxa, only 10 percent of its flora (Moran, 1967).

In addition to the 28 non-native plants that are considered to have been introduced to Santa Barbara Island, there are also a number that are native to the mainland and yet quite possibly should be treated as recently introduced to this island. For example, *Daucus pusillus* was not collected until 1963 and has never been found away from the Landing Cove area where supplies and people are usually put ashore.

1901. G. P. Kanakoff collected only one specimen, a *Lotus*.

² According to Kellogg's description of *Coreopsis* (Proc. Calif. Acad. Sci. 4:198-199, 1873).

ENDEMIC PLANTS

Roughly 100 vascular plants are restricted to the California off-shore islands and have not been found on the mainland. Fourteen of these insular endemics are native to Santa Barbara Island and constitute the most notable feature of its flora. Three endemics, *Eriogonum giganteum* var. *compactum*, *Dudleya traskiae*, and *Platystemon californicus* var. *ciliatus*, are known only from this island (figs. 4-6).



FIG. 4. A low shrub of the endemic *Eriogonum giganteum* var. *compactum* (B68-77) flowering at the Santa Barbara Botanic Garden, September 1970.



FIG. 5. *Dudleya traskiae* (Philbrick & Benedict B66-403), taxonomically the most distinctive endemic of Santa Barbara Island. Shown here, 22 May 1966, on the southwest sea bluff between Cat Canyon and Signal Peak. Last seen in the wild in 1968.

The evolution of these endemics, whether on Santa Barbara Island or some similar land mass, is quite probably associated with Pleistocene fluctuations in land area—increase in number and diversity of available habitats as land area expanded and an intense selection during periods of restricted land area.

FLORISTIC RELATIONSHIPS

One of the interesting questions to be asked about an island flora concerns the location of its nearest relatives. Such relationships provide a clue as to how the island was botanically populated. Sixty-eight plants presently reported from Santa Barbara Island are known to be part of the native flora of California (modified from Munz, 1959 & 1968) and are presumed to be native to this island. Some of these plants are shared



FIG. 6. Pressed specimens of *Platystemon californicus* var. *ciliatus* (Dunkle 7400), endemic to Santa Barbara Island. Vigorous individuals frequently measure 25 cm across and produce 50 or more flowers at one time.

with San Miguel Island (unpublished data at the Santa Barbara Botanic Garden), San Nicolas Island (Foreman, 1967; unpublished data at the Santa Barbara Botanic Garden), Santa Catalina Island (modified from Thorne, 1967 & 1969), San Clemente Island (modified from Raven, 1963, and Thorne, 1969), and Guadalupe Island (Reid Moran, personal communication, 1969). The native plants of the other California islands are not considered in this particular connection because comprehensive data are still being accumulated. Eventually the relationships between the native floras of all these islands should be investigated.

On the basis of the known number of shared native vascular plants (fig. 7), Santa Barbara Island shows its closest relationship to San Clemente Island (61 taxa shared) and Santa Catalina Island (57 taxa shared). The floristically related Guadalupe Island shares 38 taxa with Santa Barbara Island in spite of the two being separated by several hundred kilometers. San Miguel and San Nicolas both share 34 taxa with Santa Barbara.

A similar pattern of relationship is shown by examining the insular endemic plants that Santa Barbara Island shares with other islands (fig. 8, table 1). San Clemente and Santa Barbara share 10 of these taxa; Santa Catalina and Santa Barbara, eight; San Nicolas and Santa Barbara, six. The distant Guadalupe Island shares five with Santa Barbara Island. Anacapa, the nearest of the northern islands, shares four. Santa Cruz, the second nearest northern island, shares three. Santa Rosa, farther up the coast, and Los Coronados, to the south, each share two with Santa Barbara. All other of the California islands, as far south

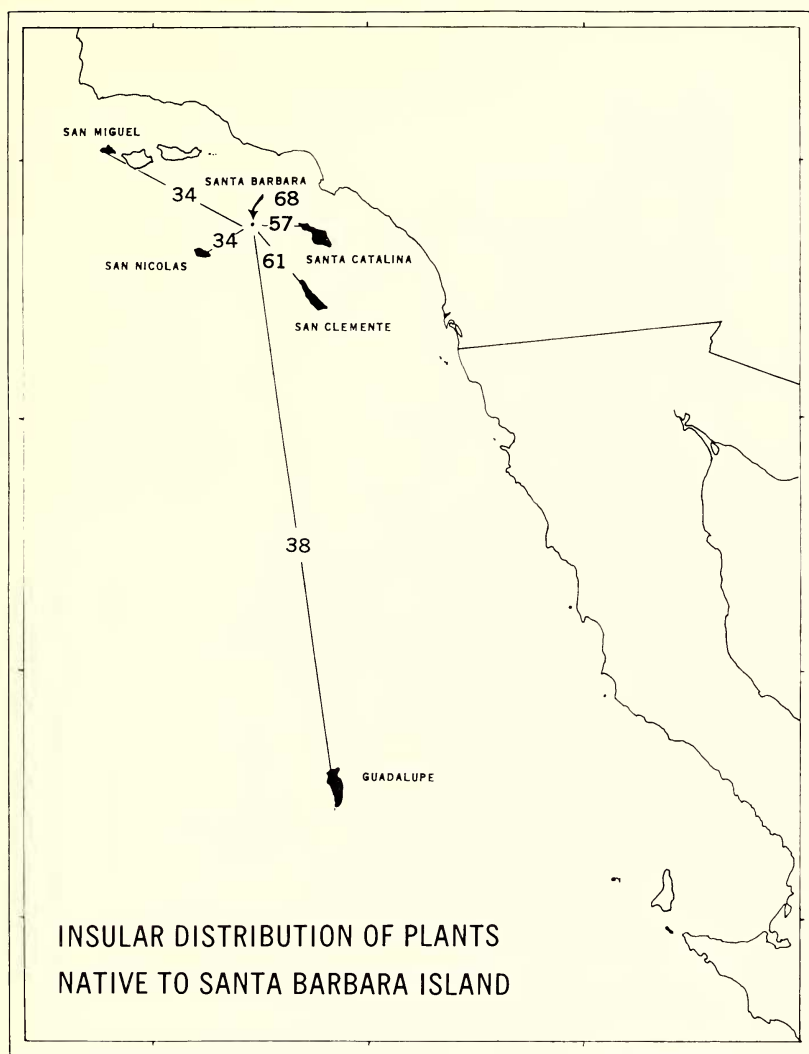


FIG. 7. All but 7 of the 68 native vascular plants known from Santa Barbara Island are a part of the relatively large flora of San Clemente Island. Santa Barbara Island also shares many plants with Santa Catalina Island. Present data indicate that the floristic affinities of Santa Barbara Island are with the southern islands. The numbers shared with islands not labeled on this map have yet to be determined.

as Natividad, share no more than a single insular endemic with Santa Barbara Island. Not one insular endemic is shared exclusively by Santa Barbara Island and any of the northern islands.

The *Phacelia* of Santa Barbara Island is of particular interest; it combines characteristics of the relatively widespread *P. distans* and the insular endemic *P. floribunda*. The former occurs on San Miguel and

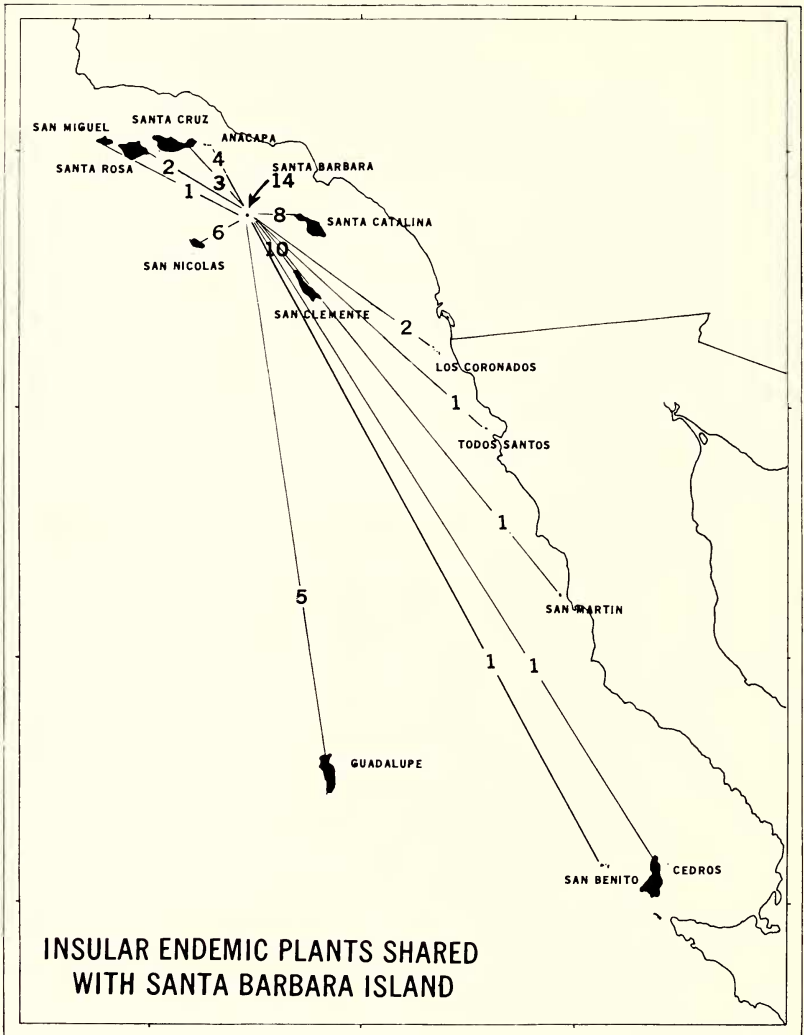


FIG. 8. Many vascular plants occur only on the California off-shore islands. Fourteen of these endemics are native to Santa Barbara Island. Ten of the 14 also occur on San Clemente Island thus indicating a close floristic relationship between these two islands. See also table 1.

Santa Catalina; *P. floribunda* occurs on Guadalupe; and both species occur on San Clemente. Although the Santa Barbara Island *Phacelia* apparently is restricted to the one island, it is not considered here as a stabilized endemic and is not included in the floristic tabulations of this paper. In addition to this *Phacelia*, the only native plants not shared with San Clemente Island are *Hutchinsia procumbens*, *Astragalus trask-*

iae, *Coreopsis gigantea*, and the three endemic taxa restricted to Santa Barbara Island.

The overall floristic relationship among most of the southern islands is indicative of relatively close proximity, similar climatic conditions, and colonization from similar plant sources by means of bird migrations, wind patterns, ocean currents, and human visitation.

PRESENT-DAY VEGETATIONAL CHANGES

Most of the dispersal of the plants making up this flora has taken place over many thousands of years; however, changes are still going on. To date five species have been eliminated from the flora of Santa Barbara Island. These are two maritime plants that were collected only once, *Camissonia cheiranthifolia* subsp. *cheiranthifolia* and *Galvezia speciosa*, and three marginally adapted introduced weeds, *Bromus diandrus*, *Brassica nigra*, and *Xanthium spinosum*. It now seems probable that the Santa Barbara Island endemic *Dudleya traskiae* has also been eliminated.

During the past 30 or so years, 20 species have been added to this flora. *Phyllospadix scouleri*, *Vulpia octoflora*, *Hesperocnide tenella*, *Opuntia littoralis* sensu stricto, and *Amsinckia spectabilis* are presumed to be native but are either inconspicuous or taxonomically difficult and probably were overlooked by previous botanists. Ten others were introduced to California or are more or less weedy California natives, which are not surprising additions to disturbed areas; these are *Avena barbata*, *Bromus mollis*, *Hordeum pusillum*, *Parapholis incurva*, *Cannabis sativa*, *Thelypodium lasiophyllum* var. *lasiophyllum*, *Daucus pusillus*, *Centaurea melitensis*, *Silybum marianum*, and *Sonchus tenerimus*. The remaining five, *Calandrinia ciliata* var. *menziesii*, *Hutchinsia procumbens*, *Pholistoma auritum* var. *auritum*, *Microseris linearifolia*, and *Rafinesquia californica*, are perhaps the most significant of the recent arrivals.

During the same 30 years, changes in distribution and frequency have been more conspicuous than additions and deletions. The populations of *Coreopsis gigantea*, which already had been nearly eliminated from the upper terraces by farming prior to Dunkle's study, now have been reduced to isolated colonies (figs. 9–12b), primarily by the burrowing and gnawing of introduced rabbits. The drastic reduction of this plant may be responsible for the apparent extinction of the Santa Barbara Island song sparrow, which was abundant prior to 1940 and was intimately associated with the *Coreopsis* thickets (Townsend, 1890, p. 139; Sumner & Bond, 1939, pp. 9–10; Dunkle, 1950, p. 280; Sumner, 1958, p. 3). Elsewhere this succulent-stemmed arborescent shrub with easily breakable branches has persisted only in scattered locations on the Southern California coast and the off-shore islands.

Greatly increased, on the other hand, is the area covered by the South African iceplant, *Mesembryanthemum crystallinum*. Dunkle (1950, p. 359) mapped this species as occupying major areas on the two peaks of the island and as coexisting with *Suaeda californica* in sev-

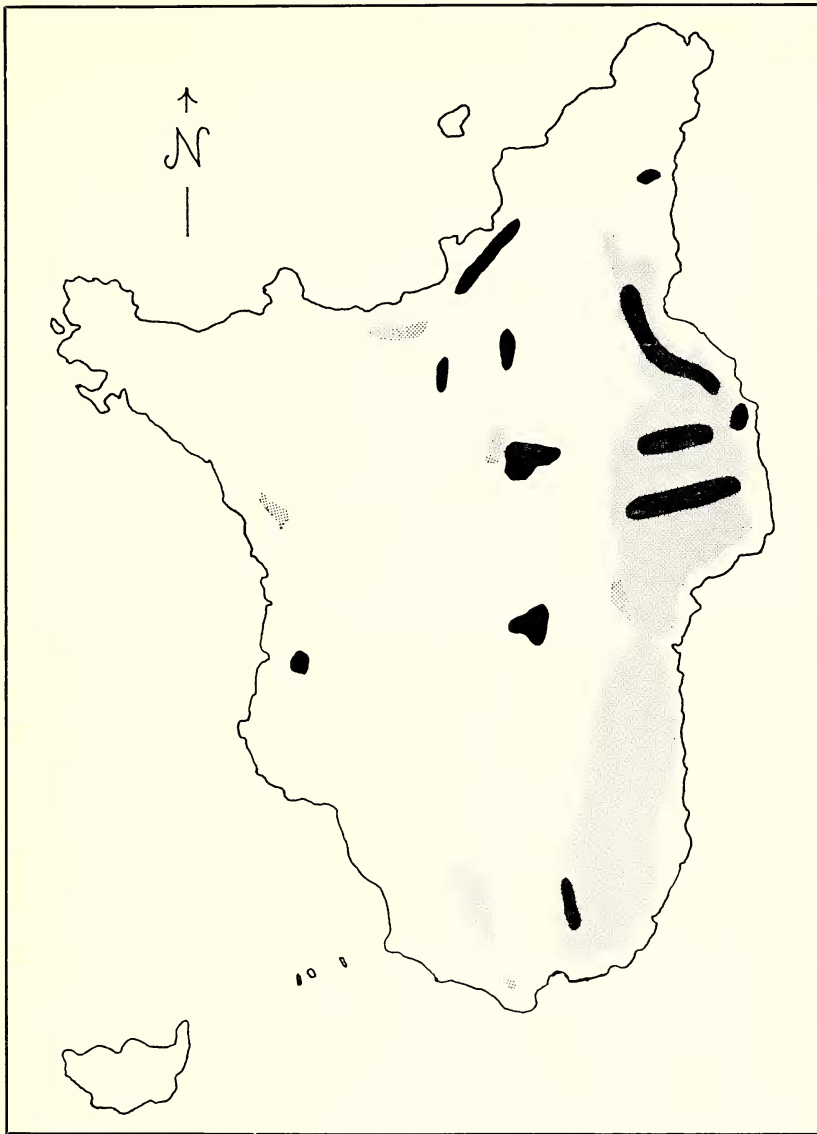


FIG. 9. Changes in the distribution of *Coreopsis gigantea* on Santa Barbara Island. Distribution for 1939-1941 is mapped in gray (from Dunkle, 1950, p. 359). Distribution for 1969-1970 is mapped in black. The reduction in the area occupied by this species is primarily the result of gnawing and tunneling by introduced rabbits.

eral sea gull nesting areas. Since that time, the iceplant has carpeted a much larger portion of the island, excluding other vegetation by physical or physiological means. When wind or other disturbance opens up small areas within this carpet, the soil often remains bare or is invaded only

by weedy introduced plants, such as *Malva parviflora* and *Erodium cicutarium*.

The major patches of *Suaeda californica*, particularly those on the West Slope, have been greatly reduced in area and density since 1968. Previous associations of *Suaeda* and *Mesembryanthemum* in gull nesting sites are now dominated by *M. crystallinum* with only a few scattered plants of *Suaeda*. From this pattern it is suggested that the gull may be important in the introduction of this iceplant and that, once established, the iceplant may contribute to the decline of the *Suaeda*. The introduced rabbits, which previously burrowed in the dense *Suaeda* patches, undoubtedly have contributed to this decline.

A third important change involves the restricted endemic *Dudleya traskiae*. By 1961 there were already in evidence many dead plants of this species (E. R. Blakley, personal communication, 1969). In 1968 only a few healthy *Dudleya* plants could be found on the island. In 1970 no live rosettes were found in any of the four locations where this plant had been previously collected. Again the major destruction is apparently due to gnawing by rabbits.

MAN'S EFFECT ON THE VEGETATION

There are only fragmentary indications of early human activities on Santa Barbara Island. A few conspicuous shell mounds give evidence of former Indian visitation. The first suggestion of danger to the vegetation is based on an implication by T. J. Farnham that goats were placed on the island prior to 1846. He wrote: "Farther off shore and southward, are the islands of Santa Barbara, San Nicolas and San Clemente. . . They are densely populated with goats" (Farnham, 1849, p. 107).

Feral house cats were extremely abundant shortly before 1896 (H. Bay Webster interview with Don Meadows, 1940). By 1908 these persistent wild cats were again numerous enough to be blamed for the drastic reduction in the nesting populations of Xantus' murrelet and the once abundant Cassin's auklet (Howell, 1917, pp. 20-22).

Britton (1897, pp. 192, 194) noted "ice-plant", "a field of malva weed", a lobsterman's "hut of lath and canvas", and "scattered . . . skulls and hoofs of sheep put on the island as a business venture some years ago". Additional introduced weeds, such as *Chenopodium murale*, were first collected in 1901 by R. E. Snodgrass.

About 1915 a group headed by the Alvin Hyder family moved to the island¹. At times this group numbered as many as 17 people. A total of 11 structures were built, and a series of catch basins and reservoirs were set up to store rainwater and water hauled from the mainland. They brought with them two mules and two horses for plowing and other farm chores. For the first three years they concentrated on raising barley

¹ The history of the Hyder activities on Santa Barbara Island is reported on the basis of a 1970 interview with Denton O. Hyder, the only son of Alvin Hyder.



FIG. 10a. Vegetation of East Slope, Santa Barbara Island, as photographed by Lowell Sumner on 15 April 1939. The foreground is dominated by introduced *Hordeum glaucum* and native *Coreopsis gigantea*. His original notation: "the broad mesa of Santa Barbara Island where exotic weeds . . . struggle with native species".



FIG. 10b. Same location as in figure 10a on 21 March 1970. In the foreground are scattered rosettes of *Mesembryanthemum crystallinum* on a carpet of dried plants of this same introduced species, the patch of *Coreopsis* obviously lost the "struggle".



FIG. 11a. A dense stand of *Coreopsis gigantea* in lower Cave Canyon, Santa Barbara Island. Photograph by Lowell Sumner, 14 April 1939.



FIG. 11b. Same location as in figure 11a on 21 March 1970. Note complete disappearance of *Coreopsis* from the south-facing slope in the foreground and the conspicuous thinning of the stand on the opposite slope.

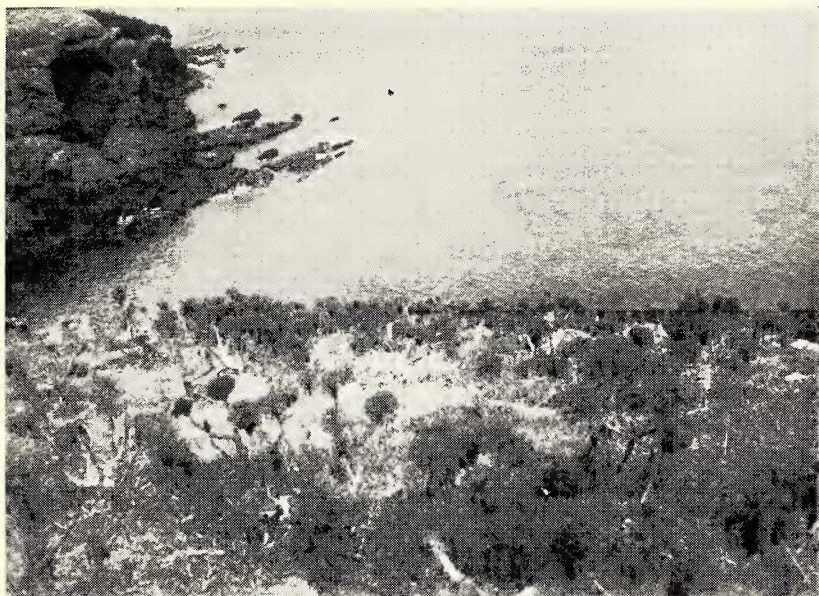


FIG. 12a. A slope with short but healthy *Coreopsis gigantea* plants on Santa Barbara Island just west of North Peak summit. Photograph by Don Meadows, 19 March 1940.



FIG. 12b. Thirty years later, 21 March 1970, at the same location as in figure 12a. Introduced *Mesembryanthemum crystallinum* has replaced the native *Coreopsis* on this west-facing slope.

hay in a large field on the East Slope just east of Signal Peak. Sheep became the primary agricultural concern during the remaining seven years of the lease. A maximum of about "200 sheep" were kept on the island at one time. The Hyders also brought approximately "2,000 Belgian hares" [*Oryctolagus*] from various sources in the Santa Ana area. Although it is estimated that the number of these rabbits might have "doubled" temporarily, this venture soon was considered a failure; and the blame was again placed on the cats. Various other animals were raised; these included geese, ducks, chickens, turkeys, pigs, and up to "25 goats". Gull eggs were systematically harvested; only one egg was taken from each nest.

Farming necessitated clearing of both the *Coreopsis* and *Mesembryanthemum*. The former was pulled up by hand; and the latter was cut, allowed to dry, and burned. These fires took place each year between about 1917 and 1921. They resulted in the burning over of nearly all the tillable portion of the island. Several acres of corn and potatoes were raised near the southern edge of the upper West Slope.

Occasional sacks of grain and a few bales of hay were brought to the island. All major landings of materials, animals, and people were confined to the Landing Cove. The conspicuous agricultural weeds of this time were "oats, mustard, foxtail, and filaree". A "castor-bean" shrub, *Ricinus*, persisted at the Landing Cove for a short time. Of all the animals that were introduced by the Hyders only the rabbit persisted, and this probably not beyond the 1940's when a different rabbit was introduced. By 1926 the Hyder group had moved off Santa Barbara Island, but during that year D. O. Hyder returned for two months to graze sheep from his family's H-A Ranch in the Cuyama Valley of northern Santa Barbara County.

In 1931 *Mesembryanthemum* was the major vegetation over most of the island; but the *Coreopsis* was in good condition, especially at the top of the cliffs on the east side of the island (I. L. Wiggins, personal communication, 1970). At that time additional introduced weeds (*Atriplex semibaccata*, *Medicago polymorpha* var. *polymorpha*, *Sonchus oleraceus*, and *Xanthium spinosum*) were documented by the collections of LeRoy Abrams and I. L. Wiggins.

By 1939 several two- to three-meter *Eucalyptus* trees had grown for a time near the Landing Cove (Sumner & Bond, 1939, p. 15). Sumner & Bond (1939, p. 10) noted droppings of "former temporarily resident dogs". Cats were comparatively common, but only three rabbits were seen on the island (Sumner, 1958, p. 7; Reddick, 1939, p. 2). "Coreopsis in the unfarmed areas was at that time much more luxuriant than later" (Sumner, 1958, p. 4). During the spring of 1941 Mr. and Mrs. Clarence Fry spent one month on the island; they saw a total of 13 cats and two rabbits (Sumner, 1958, p. 7).

From 1942 through 1946 the island served as an aircraft early warning outpost and subsequently as a photographic tracking station; motor

vehicles were in use and an increase in dirt roadways resulted (G. H. Bowen, personal communication, 1968). Barracks, miscellaneous buildings, and additional boat loading facilities were constructed; even a few sheep were again placed temporarily on the island (Sumner, 1958, p. 7). At this time "New Zealand Red" rabbits were introduced (Sumner, 1958, p. 7). However, several years passed before these rabbits, *Oryctolagus*, caused any noticeable destruction of the vegetation.

In 1949 the island continued to support vigorous thickets of *Coreopsis* at about the same time as the road system was expanded to the Webster Point area and the currently-existing timber landing platform and cable car track were constructed (Reid Moran photographs, February 1949). *Coreopsis* to "a height of 8 or 10 feet" were noted at Landing Cove; "the whole east side of the island, up to an elevation of about 400 feet" was "covered with a dense forest" of these plants (P. C. Orr field notes, 9-11 February 1949). The following year, in 1950, only one cat and two rabbits were observed as Lowell Sumner began several years of observation on the interaction of Santa Barbara Island plants and animals. He reported that

. . . the ecological effects of this new rabbit introduction were as yet scarcely evident. Two sub-adult rabbits were seen but the native "jungle" had reached such a peak of recovery that rabbit trails were almost invisible. . . . Large areas of *Coreopsis* which had been waist high in 1939 were head high in 1950. A younger generation was recapturing the old hayfield. . . . Extensive cactus patches . . . had been overwhelmed . . . by the spreading *Coreopsis*, morning glory, . . . and box thorn . . . (Sumner, 1958, p. 8).

Sumner's observations (1958, p. 4) indicate that 1952 was the approximate date of the rapid and destructive increase in the second rabbit population. The resulting decrease in *Coreopsis* and *Calystegia* and the related increase in *Mesembryanthemum* are shown in figure 13.

In 1953 the rabbits were conspicuously abundant, and the vegetation had seriously declined.

Rabbits, all of the New Zealand Red strain, ran about in great numbers. The *Coreopsis* "jungle" had a stricken aspect. Many of the trees had been girdled and felled by the rabbits. . . . Throughout the thinning stands of survivors, bare ground showed everywhere through a shriveled carpet of dying vegetation. . . . This was because nearly all of the "forest" understory of low annuals, and of perennials such as the trailing morning glory, had been killed by the rabbits (Sumner, 1958, pp. 8-9).

There had been previous unofficial rabbit shooting on the island, and in October 1954 a rabbit control program was begun by the National Park Service and the U.S. Fish and Wildlife Service. At that time the

vegetation, even on nearly inaccessible cliffs, was spectacularly reduced by the gnawing of an estimated 712 rabbits.

Living vegetation was so sparse that rabbit shooters could walk almost anywhere through the withering jungle. The rabbit population now so far exceeded the available burrows and concealing thickets that scores of the animals crouched in plain sight on the bare ground, taking advantage of any slight shade afforded by the surviving *Coreopsis*. Acres of box thorn [and] island sagebrush . . . had been exterminated. The giant morning glory was reduced to a few leafless, prostrate runners except where an occasional plant had been able to put out a few leaves beyond reach of the rabbits by climbing to the top of a still-standing *Coreopsis* (Sumner, 1958, p. 10).

In 1955 the estimated rabbit population reached 2,621; and the iceplant, *Mesembryanthemum crystallinum*, was rapidly increasing (fig. 13). That same year the rabbit control program was expanded to include strychnine poisoning.

Iceplant . . . had staged a conspicuous, large-scale invasion of previously denuded ground and extended even beneath the *Coreopsis*, where it replaced the native wildflowers of earlier years (Sumner, 1958, p. 12).

Although the 1956 rabbit estimate was down to 727, this was still far too many; and the native vegetation declined even further while the introduced iceplant continued to spread.

Coreopsis had been reduced by 25 to 30 percent through beavering, girdling and undermining. Wild cucumber, formerly common but not a preferred rabbit food, was reduced to an occasional small green runner. Morning glory, the best indicator of rabbit pressure, was so far gone that in three days the writer found only one plant that showed slight signs of current life. Small wild flowers seemed almost non-existent, and even the hardy Mediterranean grasses were greatly reduced. . . . Iceplant continued to spread enormously, forming dense carpets on most of the open ground outside of the *Coreopsis* patches. By now it had replaced most of the native plants and had even to a large extent replaced the dense wild oat stands in the former hayfield (Sumner, 1958, pp. 13-14).

The last known evidence of cats on Santa Barbara Island (Sumner, 1958, p. 17) is for the year 1957. During that year a continuation of the annual shooting and poisoning reduced the rabbit population to an estimated 560. Still the number was too high, and the vegetation continued to decline.

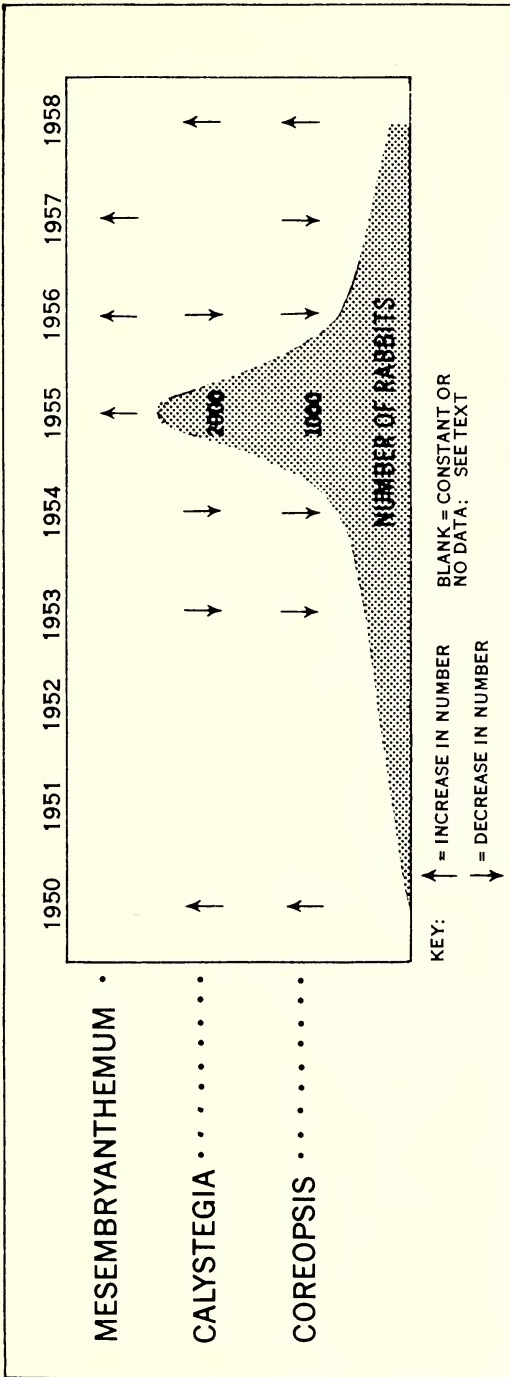


FIG. 13. Increase and decrease of three selected plants in relation to changes in the number of introduced rabbits on Santa Barbara Island. The rabbit population increased between 1950 and 1955. These animals drastically reduced the native populations of *Coreopsis gigantea* and *Calystegia macrostegia* thus allowing the area occupied by the relatively rabbit-resistant *Mesembryanthemum crystallinum* to increase spectacularly from 1955 through 1957. Rabbit poisoning was begun in 1955; this, in addition to increased rainfall, allowed the native vegetation to begin a modest recovery in 1958. (Data from Sumner, 1958, pp. 8-21.)

The vegetation . . . had suffered a decline even more pronounced than that of the rabbits. Approximately 50 percent of the *Coreopsis* was dead and prostrate. The bulk of the morning glories had been able to keep no leaves or runners, and appeared nearly dead. . . . Acres of box thorn appeared to be nearly dead. Even the brome grasses and wild oats were sparse; cheat grass was now the dominant surviving grass but had attained an average height of only 6 inches. . . . Iceplant had continued to make enormous gains, occupying nearly all ground laid bare by the rabbits. More than half the surface of the island now appeared covered by it . . . (Sumner, 1958, pp. 15-16).

In 1958 Sumner noted that the "song sparrows were still holding their own" (Sumner, 1958, p. 19); this is the last known field report of this endemic bird. Yet heavy rainfall and a further reduction in the number of rabbits combined to allow the vegetation to begin to recover (fig. 13).

Surviving *Coreopsis* were putting on a blazing show of golden yellow. . . . The first new young plants of this species since the rabbit outbreak were now observed. The number of such young plants was considerably less than $\frac{1}{2}$ of 1 percent of the total stand, and some of them had been partly eaten by rabbits. . . . Morning glory had revived appreciably, even in areas where most of the plants had, during the previous two years, appeared virtually lifeless. . . . Box thorn showed the first extensive development of new leaves in years, though approximately 35 percent of the original stand was dead. Island sagebrush exhibited strong recovery. Wild cucumber had revived. Annual wildflowers seen rarely or not at all since 1950 were common to profuse. . . . Wild oats [were] . . . waist and shoulder high. . . . The foxtail and brome grasses experienced a comparable resurgence. . . . Iceplant had attained astounding luxuriance and density, forming on 50 percent or more of the island a tough, slippery, wet barrier twelve to eighteen inches deep (!) very difficult for human beings to wade through and impenetrable to the rabbits (Sumner, 1958, pp. 17-18).

Then in the summer of 1959 an accidental fire covered most of the island. "It burned nearly all the vegetation from water's edge on the east shore of the island to the crest of the ridge where it was halted by the strong winds from the west slope. . . . Two-thirds of the island was denuded right down to mineral soil. . . . There were perhaps 30 rabbits left on the vegetated west slope; the others either were killed outright or could find nothing to eat" (Lowell Sumner, personal communication, 1970).

The Park Service has continued efforts to control the introduced rabbits. However, as even selective poisoning increases the risk to the native animals of the island, the main emphasis is now on shooting. To date, the rabbits have not been exterminated, and destruction of the vegetation continues.

Fishermen have stopped at the island for many years, and the Coast Guard has operated a lighthouse near the northeast corner of the island since 1929 (U.S. Coast Guard, Light list 3:32, 1969). Established as a National Monument in 1938, the island now has several hundred visitors each year. To the untrained eye there are only a few clues to the history of man's activities on Santa Barbara Island, but it is quite certain that the island would look very different today if domestic animals had never been introduced there.

SUMMARY AND CONCLUSION

The small flora of Santa Barbara Island, although sharing elements with other portions of California (especially with San Clemente Island), is of interest because of the accumulation of several unique plants during a period of less than a million years. These endemic plants are varieties of *Eriogonum* and *Platystemon* and a species of *Dudleya*.

In the last few decades native species of *Suaeda*, *Dudleya*, *Coreopsis*, and other genera have been drastically reduced on this island. In large part, they have been replaced by expansion of an introduced *Mesembryanthemum*.

Hopefully this paper will do more than serve as a demonstration of the influence of man, weeds, and introduced animals. Perhaps it will help urge preservation of the native plants and animals of Santa Barbara Island so that they remain available for further study, particularly from an evolutionary and ecological point of view.

ACKNOWLEDGMENTS

In addition to the numerous credits given throughout this paper and to the curators of the herbaria cited in the plant list, special acknowledgment is due Edwin R. Chandler for his frequent assistance with critical determinations, Peter H. Raven for reading and criticizing nearly all of the manuscript, and Michael R. Benedict for pertinent discussions and help in field-checking the manuscript. Major portions of this paper have benefited from the editorial assistance of J. Robert Haller, Katherine K. Muller, and Jane E. Philbrick.

The 1939 and 1940 photographs were taken by E. Lowell Sumner, Jr., retired from the National Park Service, and by Donald C. Meadows, then with the Los Angeles County Museum. Other early photographs were kindly provided for comparative study; these were taken by Reid Moran, Meryl B. Dunkle, Merrill C. Allyn, and the Alvin Hyder family.

Historical information was obtained primarily from Denton O. Hyder, Don Meadows, Lowell Sumner, and George H. Bowen.

Typing, indexing, and proofreading were done by Faith Harder. The graph and maps were prepared by Jacqueline P. Broughton. Collections made by the Santa Barbara Botanic Garden were with permission of the National Park Service. Transportation was provided by U.S. Marine helicopters and by the boats *Cougar* and *Golden Doubloon*; the consideration of the crews and fellow passengers is appreciated.

Meryl B. Dunkle's pioneer botanical study of Santa Barbara Island provided the major background for the present work.

LIST OF VASCULAR PLANTS

The specimens cited for each taxon are arranged geographically, starting with Arch Point, at the northeast corner of the island, and continuing more or less clockwise to Webster Point. Those cited without collector were collected by the author; those without herbarium are at the Santa Barbara Botanic Garden (SBBG). The angiosperm families are arranged according to Dalla Torre and Harms.

Polypodiaceae

POLYPODIUM CALIFORNICUM Kaulf. Known only from Cave and Middle canyons. Rare, north exposure, rocky ledge, first canyon south [Cave Canyon], 20 March 1940, *Dunkle 7440* (LAM); triangular-shaped colony about 8 by 11 feet, upper of two populations, with *Marah*, *Coreopsis*, *Melica*, rock covered with few inches of soil, north-facing slope, middle Cave Canyon, 15 March 1969, *Philbrick & Ricker B69-34*; lower of two populations, north-facing slope, middle Cave Canyon, 15 March 1969, *Philbrick & Ricker B69-33*; about 50 yards from mouth of Middle Canyon, 5 May 1963, *Piehl 63-162* (SBBG, US). By transposition of column headings for Santa Catalina and Santa Barbara islands Dunkle (1950, p. 293) accidentally indicated several other ferns in the genera, *Polypodium*, *Pityrogramma*, *Adiantum*, *Pellaea*, and *Cheilanthes* as occurring on Santa Barbara Island.

Zosteraceae

PHYLLOSPADIX SCOULERI Hook. Not reported by Dunkle or Sumner & Bond. Tidal pool below mouth of Graveyard Canyon, 22 May 1966, *Philbrick & Benedict B66-418*; low tide level, exposed surf, southwest portion of the Hook, Webster Point peninsula, 21 March 1970, *Philbrick & Benedict B70-35a*.

PHYLLOSPADIX TORREYI S. Wats. Reported by Dunkle (1940, p. 2).

Low tide level, exposed surf, southwest portion of the Hook, Webster Point peninsula, 21 March 1970, *Philbrick & Benedict B70-35* (RSA, SBBG), determined by R. F. Thorne, 1970. One or both of the above species also have been collected near Cliff Canyon, Landing Cove, and Cave Canyon; however, positive identification could not be made from the material obtained. These taxa are very similar but differ in length of pistillate flowering stems, number of pistillate spadices per flowering stem, and shape of mature nutlets.

Gramineae

AVENA BARBATA Pott ex Link. Not reported by Dunkle or Sumner & Bond. Less common than *A. fatua*, exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-177*; scattered, north slope of Signal Peak, 4 May 1963, *Blakley 5674* (DS, SBBG).

AVENA FATUA L. (*A. f.* var. *glabrata* Peterm.). Sumner & Bond (1939, pp. 12-13) indicated "noticeably abundant" or "dominant in some areas". Dunkle (1940, p. 2) reported: "A common grass on the east slopes where it forms large, well-defined colonies. It grows particularly rank above the head of the landing cove." This grass is still very common with *Amsinckia intermedia* over most of the East Slope of the island. No definite locality, 14 April 1939, *Bond 402* (SBM 14906, 14907); abundant, deep soil, Landing Cove, 21 March 1940, *Dunkle 7454* (LAM); middle of east-facing slope, Landing Cove, 18 March 1968, *B68-46* (MICH, RSA, SBBG, SD); south-facing slope, middle Cave Canyon, 15 March 1969, *Philbrick & Ricker B69-44*.

BROMUS ARIZONICUS (Shear) Steb. (*B. catharticus* Vahl of Dunkle, 1940; *B. marginatus* Nees of Dunkle, 1942). For *B. catharticus*, Dunkle (1940, p. 3) reported: "In deep soil of the landing cove". For *B. marginatus*, he (Dunkle, 1942, pp. 128-129) indicated "only one locality known". Several locations in the northern portion of the island now known for *B. arizonicus*, but nowhere is it abundant. Interrupted irregular patch 15 by 30 feet, west of Cliff Canyon, opposite Shag Rock, 15 March 1969, *Philbrick & Ricker B69-55* (MICH, SBBG, US); few in colony, mesa slope east of North Peak, 4 May 1963, *Piehl 63-128* (RSA, SBBG); uncommon, deep soil, Landing Cove, 21 March 1940, *Dunkle 7455* (AHFH, LAM), determined by G. L. Stebbins, 1969, as an unusual form with flattened spikelets and short awns; middle of east-facing slope, Landing Cove, 18 March 1968, *B68-42*; north-facing slope, upper third of Cave Canyon, 27 April 1968, *Philbrick & McPherson B68-219*; clump, 1 foot in diameter, with *Eriogonum*, *Astragalus*, *Trifolium palmeri*, summit area, North Peak, 29 April 1969, *B69-68*. Also seen at Middle Canyon and West Slope. Distinguished from *B. carinatus*

H. & A. by the length of the upper glume about equalling that of the lowest lemma and by the relatively glabrous or short-pubescent dorsal surface of the lemma between the midrib and margin (Stebbins *et al.*, Proc. Calif. Acad. Sci., ser. 4, 25:307-322, 1944).

BROMUS DIANDRUS Roth (*B. rigidus* Roth of some authors). For *B. rigidus*, Dunkle (1940, p. 3) reported: "A few plants grow along the trail from the landing cove." No recent collections are known. Occasional, canyon bank, east side Landing, 30 May 1939, *Dunkle 8139* (AHFH, LAM); common, rocky bank, east side Landing, 30 May 1939, *Dunkle 8141* (AHFH, LAM).

BROMUS MOLLIS L. (*B. hordeaceus* L. of some authors). Not reported by Dunkle or Sumner & Bond; presently restricted to Landing Cove and adjacent areas. Scattered, under *Coreopsis*, beach bluffs, Landing Cove, 4 May 1963, *Blakley 5685* (MICH, SBBG, US); just north of middle Cave Canyon, 19 March 1968, *B68-64*. The Santa Barbara Island plant is not the taxon which has been treated by some as *B. molliformis* Lloyd.

BROMUS RUBENS L. (*B. sterilis* L. of Sumner & Bond, 1939; *B. orcuttianus* Vasey of Dunkle, 1940). Sumner & Bond (1939, p. 12) indicated "noticeably abundant" or "dominant in some areas" for both *B. rubens* and *B. sterilis*. For *B. rubens*, Dunkle (1940, p. 3) reported: "A few plants along the trail from the landing"; for *B. orcuttianus*, he reported (1940, p. 3): ". . . shaded parts of canyon bottoms". No definite locality, 14 April 1939, *Bond 373* (SBM), as "*B. sterilis*?"; no definite locality, 14 April 1939, *Bond 395* (SBM); short plants, dominant with *Avena fatua*, mesa slope east of North Peak, 4 May 1963, *Piehl 63-127* (SBBG, US); infrequent, rocky bluff, east side Landing, 30 May 1939, *Dunkle 8142* (AHFH); common, shaded bottom, second canyon south [Middle Canyon], 19 March 1940 *Dunkle 7423* (AHFH, LAM); south-facing slope, base of small rock cliff below fork of Graveyard Canyon, 27 April 1968, *Philbrick & McPherson B68-228*; common, with *Mesembryanthemum*, sides of Cat Canyon, 4 May 1963, *Blakley 5656* (MICH, SBBG); common, top of Signal Peak, 4 May 1963, *Blakley 5665* (CAS, SBBG, SD). Also seen at Cliff Canyon, Cave Canyon, North Peak, and West Slope.

{*Bromus sterilis* L. Cited by Sumner & Bond (1939, p. 12), but this is probably based on *Bond 373*, which is *B. rubens*. According to Dunkle (1942, pp. 128-129) "only one locality known" for *B. sterilis*; this occurrence not confirmed although the species is reported for Santa Catalina Island.}

BROMUS TRINII Desv. [*B. vulgaris* (Hook.) Shear of Dunkle, 1940].

Presently confined to the northeast portion of the island. Scattered, exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-173*; near center of Cave Canyon, 4 May 1963, *Blakley 5619* (CAS, MICH, SBBG, US); infrequent, shaded side, second canyon south [Middle Canyon], 19 March 1940, *Dunkle 7424* (AHFH, LAM), as *B. vulgaris*; south-facing slope, lower Middle Canyon, 15 March 1969, *Philbrick & Ricker B69-46* (MICH, SBBG, US).

HORDEUM GLAUCUM Steud. (*H. stebbinsii* Covas; *H. murinum* L., in part). For *H. murinum*, Sumner & Bond (1939, p. 12) indicated "noticeably abundant" or "dominant in some areas". Dunkle (1940, p. 3) reported: "The most common and widespread grass on the island where it forms a vast mat on the eastern open slopes". Although abundant, this grass is now far less conspicuous than *Avena fatua* on the eastern half of the island. No definite locality, 14 April 1939, *Bond 400* (SBM); dominant plant of island, slopes, east side, 28 May 1939, *Dunkle 8108* (AHFH, LAM); few, mesa slope east of North Peak, 4 May 1963, *Piehl 63-126*; with *Avena*, *Bromus rubens*, middle of east-facing slope, Landing Cove, 18 March 1968, *B68-48*; terrace just south of lower Middle Canyon, 15 March 1969, *Philbrick & Ricker B69-38* (RSA, SBBG); forming large grassy areas, north slope of Signal Peak, 4 May 1963, *Blakley 5673* (CAS, SBBG); west-facing slope between North Peak and Signal Peak, 12 June 1964, *B64-10* (MICH, SBBG, US). Also seen at Cliff Canyon, Cave Canyon, North Peak, West Slope, and Webster Point. Distinguished from *H. leporinum* Link, by length of cilia on rachis segment margin and by length of prolongation of lateral spikelet rachilla (Covas, Madroño 10:1-21, 1949).

HORDEUM PUSILLUM Nutt. Not reported by Dunkle or Sumner & Bond. Primarily restricted to the terrace slopes near the eastern canyons. North of middle Cave Canyon, west of buildings, 19 March 1968, *B68-65*; few, exposed cliffs, Landing Cove, 5 May 1963 *Piehl 63-172*; head of Graveyard Canyon near road, 27 April 1968, *Philbrick & McPherson B68-232*.

LAMARCKIA AUREA (L.) Moench. Infrequent, open slope, east side, 28 May 1939, *Dunkle 8124* (LAM); few, scattered, mesa slope east of North Peak, 4 May 1963, *Piehl 63-125* (MICH, SBBG); terrace just north of Landing Cove, 18 March 1968, *B68-29* (CAS, SBBG, US); uncommon, openings among *Coreopsis* near Camp [Landing Cove], 21 March 1940, *Dunkle 7458* (LAM); few, scattered, sea cliff, mouth of Middle Canyon, 5 May 1963, *Piehl 63-154*; between Middle and Graveyard canyons, 21 May 1966, *Philbrick & Benedict B66-365*. Also seen in Cave Canyon.

MELICA IMPERFECTA Trin. Presently confined to Cave and Middle

canyons. Common, north[-facing] slope, head of Cave Canyon, 4 May 1963, *Blakley 5611* (DS, SBBG); common, north[-facing] slope near center of Cave Canyon, 4 May 1963, *Blakley 5620* (DS, SBBG); common locally, shaded bottom, second canyon south [Middle Canyon], 20 March 1940, *Dunkle 7438* (LAM).

MUHLENBERGIA MICROSPERMA (DC.) Kunth. Presently restricted to the eastern portion of the island. No definite locality, 14 May 1940, *Bond 506* (SBM); rocky ledge, northern edge of upper Landing Cove, 18 March 1968, *B68-30*; few, canyon bottom, head of Cave Canyon, 4 May 1963, *Blakley 5614*; common, south exposure, second canyon south [Middle Canyon], 19 March 1940, *Dunkle 7421* (LAM); south-facing slope, north fork of Graveyard Canyon, 27 April 1968, *B68-230*; southwest-facing slope, east of Sutil Island, 16 March 1969, *Philbrick & Ricker B69-60* (CAS, SBBG, US).

PARAPHOLIS INCURVA (L.) C. E. Hubb. Only one location known; not reported by Dunkle or Sumner & Bond. Luxuriant, interrupted patch, 3 by 25 feet, oriented along contour at irregular narrow interface above *Lasthenia* and below *Mesembryanthemum crystallinum*, northwest-facing slope, north base of Webster Point peninsula between point and North Peak, 29 April 1969, *B69-81* (CAS, MICH, SBBG, US), *B69-82* (SBBG).

PHALARIS MINOR Retz. "Noticeably abundant" or "dominant in some areas" (Sumner & Bond, 1939, pp. 12-13). Few, small eroded gully, Landing Cove, 4 May 1963, *Blakley 5680* (CAS, SBBG, SD); southwest of buildings between Landing Cove and Cave Canyon, 21 May 1966, *Philbrick & Benedict B66-370*; north-facing slope, middle of Cave Canyon, 27 April 1968, *Philbrick & McPherson B68-211* (MICH, SBBG, US). Also seen in Middle Canyon.

POLYPOGON MONSPELIENSIS (L.) Desf. To date found only in the Landing Cove area. Rare, lava crevices above high tide, east Landing, 30 May 1939, *Dunkle 8148* (AHFH); few, north[-facing] cliff near tramway track, Landing Cove, 21 October 1961, *Blakley 4791*; north-facing rocky cliff just east of wooden platform, Landing Cove, 21 March 1970, *Philbrick & Benedict B70-44*.

STIPA PULCHRA Hitchc. [*S. lepida* Hitchc. var. *andersonii* (Vasey) Hitchc. of Dunkle, 1940]. Now known only from scattered locations in the central portion of the island. With *Calystegia*, *Amblyopappus*, *Opuntia prolifera*, above fork in upper Graveyard Canyon, 19 March 1968, *B68-83* (MICH, SBBG, US); canyon head [Cat Canyon], south side, 28 May 1939, *Dunkle 8109* (LAM); west-facing slope between North Peak and Signal Peak, 12 June 1964, *B64-7*.

VULPIA MEGALURA (Nutt.) Rydb. (*Festuca megalura* Nutt.). Primarily confined to the eastern canyon area. Common, rocky bank, east side Landing, 30 May 1939, *Dunkle 8140* (LAM); beach bluffs, Landing Cove, 4 May 1963, *Blakley 5684* (DS, SBBG); trough of Cave Canyon, 5 May 1963, *Piehl 63-150a*; common, bottom of center Middle Canyon, 4 May 1963, *Blakley 5643* (DS, SBBG); north-facing slope, extreme upper north fork, Graveyard Canyon, 27 April 1968, *Philbrick & McPherson B68-231*.

VULPIA OCTOFLORA (Walt.) Rydb. (*Festuca octoflora* Walt.). Not reported by Dunkle or Sumner & Bond. Now known from the eastern canyons. More or less exposed cliff, Landing Cove, 4 May 1963, *Piehl 63-144* (MICH, SBBG, US); dense colony, sea cliff, mouth of Middle Canyon, 5 May 1963, *Piehl 63-156* (MICH, SBBG, US). For both of these specimens the maximum hair length on the dorsal surface of the lemma is 0.2 mm, as opposed to about 0.3 mm for San Clemente Island and about 0.1 mm for San Miguel Island.

Liliaceae

DICHELOSTEMMA PULCHELLUM (Salisb.) Heller [*Brodiaea pulchella* (Salisb.) Green, *B. capitata* Benth.]. For *B. capitata*, Dunkle (1940, p. 4) reported: "Rather generally scattered over the entire island". Today known primarily from the eastern portion of the island. West of Cliff Canyon, opposite Shag Rock, 15 March 1969, *Philbrick & Ricker B69-56*; south-facing slope, lower-middle Cliff Canyon, 15 March 1969, *Philbrick & Ricker B69-49*; Landing Cove, 18 March 1968, *B68-59*; north-facing slope near mouth of Middle Canyon, 15 March 1969, *Philbrick & Ricker B69-39*; junction of forks, Graveyard Canyon, 15 March 1969, *Philbrick & Ricker B69-35*; abundant, hillside, west end, 18 March 1940, *Dunkle 7419* (AHFH, LAM). Also seen at Cave Canyon and North Peak.

Moraceae

CANNABIS SATIVA L. Not reported by Dunkle or Sumner & Bond. Tight cluster of two-leafed seedlings germinating from apparent animal seed cache, north-facing slope, lower Middle Canyon, 23 March 1968, *B68-76*.

Urticaceae

HESPEROCNIDE TENELLA Torr. Not reported by Dunkle or Sumner

& Bond. Found only in Cave Canyon. Noted only once, under other vegetation, south bank of Cave Canyon, 5 May 1963, *Piehl* 63-152.

PARIETARIA HESPERA Hinton (*P. floridana* Nutt. of some authors). Known primarily from the northeast portion of the island. Cliff Canyon, 18 March 1968, *B68-36*; east-facing slope just south of Landing Cove, 15 March 1969, *Philbrick & Ricker B69-43*; few, shade, crevices of rocky cliff near center of Cave Canyon, 4 May 1963, *Blakley 5624* (CAS, SBBG); infrequent-rare, shade of *Coreopsis*, bottom of second canyon south [Middle Canyon], 19 March 1940, *Dunkle 7422* (AHFH, LAM); common, cactus patch, head of Graveyard Canyon, 21 March 1940, *Dunkle 7448* (AHFH, LAM); with *Crassula*, upper northwest slope of North Peak, 13 February 1970, *B70-2*. For information on two proposed varieties of this species, see Hinton (*Sida* 3:293-297, 1969).

Polygonaceae

{*Eriogonum arborescens* Greene. Reported by Davidson & Moxley (*Flora S. Calif.*, p. 111, 1923) for "Santa Barbara and Santa Cruz Islands". The occurrence on the former island is doubtful.}

ERIOGONUM GIGANTEUM var. COMPACTUM Dunkle (*E. giganteum* subsp. *giganteum* of Raven, *Proc. Symp. Biol. Calif. Islands*, p. 60, 1967). See figure 4 in introductory text. "On sea bluffs, especially common on the north-west side" (Dunkle, 1940, p. 4). "Locally common on north, south, and east bluffs" (Dunkle, 1950, p. 327). Known primarily from the more inaccessible sea cliffs. No definite locality, August 1901, *Snodgrass s.n.* (DS 491714); no definite locality, 3 July 1931, *Abrams & Wiggins 311* (DS); low compact shrub about $\frac{1}{3}$ to $\frac{1}{2}$ m high, with *Cryptantha maritima*, *Atriplex californica*, east-facing sea bluff north of Cliff Canyon, 27 April 1968, *Thorne 37545* (SD); shallow soil, bluff, Landing Cove, 27 September 1941, *Dunkle 8704* (LAM, type); with *Coreopsis*, shady beach bluff, Landing Cove, 22 October 1961, *Blakley 4812* (MICH, SBBG, SD); few, rocky outcropping, mouth of Middle Canyon, 22 October 1961, *Blakley 4815* (MICH, SBBG, US); rare, rocky sea bluff, south end, 28 May 1939, *Dunkle 8103* (LAM); rounded shrub about 2 feet tall, common, undisturbed area, south slope [of Signal Peak], 10 February 1949, *Moran 3157* (DS, SD, UC); regenerating plant having only small new leaves, with few normal individuals nearby, upper northwest slope of North Peak, 13 February 1970, *B70-5*; base of south side of Webster Point, 4 May 1963, *Piehl 63-119*; south-facing slope, halfway up west ridge, Sutil Island, 20 March 1968, *B68-86*. Endemic taxon restricted to Santa Barbara Island but closely related to the subspecies of Santa Catalina (*E. g.* subsp. *giganteum*) and of San Clemente (*E. g.* subsp. *formosum*) islands. "This plant formerly reported

as *E. giganteum* Wats. has such differing characteristics from the species as to warrant raising it to the varietal rank. The plant differs from the species in being lower, 4–6 dm. tall, much more compacted and with the pubescence at the base of the plant, the lower side of the leaves, and the inflorescence much more densely white-wooly. The peduncle is first 3-branched, then usually 2-branched, with the ultimate branches very short, .2–2.5 cm. long. The inflorescence is compacted into from 3 to 9 very compacted, subcapitate clusters. The involucre are sessile. Dunkle No. 8704" (Dunkle, 1942, p. 130, type description).

{*Eriogonum grande* Greene. Accidentally indicated (Dunkle, 1950, p. 293) as dominant on Santa Barbara Island by transposition of column headings for Santa Catalina and Santa Barbara islands. Not known for the latter island. }

PTEROSTEGIA DRYMARIOIDES F. & M. Known primarily from the northern portion of the island. Frequent, cliff, Landing Cove, 4 May 1963, *Piehl 63-145*; common, around rocks and under *Coreopsis*, head of Cave Canyon, 4 May 1963, *Blakley 5616*; infrequent, hillside, west end, 18 March 1940, *Dunkle 7414* (LAM). Also seen at Cliff Canyon, Middle Canyon, Graveyard Canyon, and North Peak.

Chenopodiaceae

APHANISMA BLITOIDES Nutt. ex Moq. (*Atriplex rosea* L. of Dunkle, 1940). Reported by Jepson (Flora Calif. 1:430, 1914). The two collections, which Dunkle (1940, p. 5) cited for *Atriplex rosea*, are *Aphanisma blitoides*. The latter species was also reported by Dunkle (1940, p. 4) but apparently on the basis of these same two collections. *Aphanisma blitoides* is now known from scattered south- and west-facing locations. Uncommon, dry south exposure, Landing Cove, 21 March 1940, *Dunkle 7459* (AHFH, LAM), as *Atriplex rosea*; few colonies, open slope, Landing Cove, 4 May 1963, *Piehl 63-142* (SBBG, SD); scattered, south[-facing] slope, Cave Canyon, 4 May 1963, *Blakley 5612* (MICH, RSA, SBBG); just south of Graveyard Canyon, 19 March 1968, *B68-81*; west-facing slope, Cat Canyon, 22 May 1966, *Philbrick & Benedict B66-413*; rare, flat terrace, west end, 18 March 1940, *Dunkle 7416* (AHFH, LAM), as *Atriplex rosea*. Also seen at East Slope and Middle Canyon.

ATRIPLEX CALIFORNICA Moq. Known from widely scattered locations; most conspicuous in the Cliff Canyon area. Common, rocky sea bluff, east coast, 28 May 1939, *Dunkle 8119* (LAM); forming mats, scattered, east terrace, 21 October 1961, *Blakley 4810*; gray clumps, common, rocky areas, Cliff Canyon, 5 May 1963, *Blakley 5698*; one

plant among rocks and chollas, between Cat Canyon and Signal Peak, 4 May 1963, *Blakley 5659* (MICH, SBBG); abundant, cliff ledge, "Brewster Point" [Webster Point], 18 March 1940, *Dunkle 7410* (LAM). Also seen at Landing Cove.

ATRIPLEX SEMIBACCATA R. Br. No definite locality, 3 July 1931, *Abrams & Wiggins 287* (DS); abundant, slope, east side, 28 May 1939, *Dunkle 8123* (AHFH); scattered, cliff west of Arch Point, 21 October 1961, *Blakley 4792* (CAS, SBBG, US); Cliff Canyon, 18 March 1968, *B68-23* (SBBG, SD); terrace just north of Landing Cove, near shell mound, 18 March 1968, *B68-27* (MICH, SBBG); scattered, near center of Middle Canyon, 4 May 1963, *Blakley 5644* (RSA, SBBG); bluff due north of North Peak, 21 May 1966, *Philbrick & Benedict B66-378* (RSA, SBBG); south-facing slope just below summit, Sutil Island, 20 March 1968, *B68-90* (MICH, SBBG, US). Also seen at Cave Canyon, Cat Canyon, West Slope, Webster Point, and rock off Webster Point. By transposition of column headings *Dunkle* (1950, p. 293) accidentally indicated three additional species of *Atriplex* as occurring on Santa Barbara Island.

{*Chenopodium album* L. Cited by Sumner & Bond (1939, p. 13); this occurrence is doubtful.}

CHENOPODIUM CALIFORNICUM (S. Wats.) S. Wats. Known primarily from the northeast portion of the island. Infrequent, north slope, east side, 28 May 1939, *Dunkle 8116* (LAM); common, deep soil, Landing Cove, 21 March 1940, *Dunkle 7453* (LAM); north[-facing] slope near center of Cave Canyon, 4 May 1963, *Blakley 5621*; semi-shade under *Coreopsis*, rocky north[-facing] slope, Middle Canyon, 22 October 1961, *Blakley 4816*.

CHENOPODIUM MURALE L. No definite locality, August 1901, *Snodgrass s.n.* (DS 16844), determined by H. A. Wahl, 1965; no definite locality, 3 July 1931, *Abrams & Wiggins 291* (DS), determined by H. A. Wahl, 1965; locally common, grassy terraces with *Mesembryanthemum crystallinum*, east side, 28 May 1939, *Dunkle 8100* (AHFH, LAM); few, edge of cliff, west of Arch Point, 21 October 1961, *Blakley 4795* (CAS, SBBG); abundant, deep soil, Landing Cove, 21 March 1940, *Dunkle 7456* (LAM); scattered, north[-facing] slope, base of cliff, mouth of Cave Canyon, 4 May 1963, *Blakley 5631* (RSA, SBBG); scattered, north[-facing] slope, Graveyard Canyon, 21 October 1961, *Blakley 4806* (SBBG, SD); scattered, rocky top of beach bluff between Graveyard and Cat canyons, 4 May 1963, *Blakley 5654*; west-facing slope between North Peak and Signal Peak, 12 June 1964, *B64-8*; south-facing slope just below summit, Sutil Island, 20 March 1968, *B68-89*

(MICH, SBBG, US). Also seen at Cliff Canyon, Middle Canyon, Cat Canyon, Webster Point, and rock off Webster Point.

SUAEDA CALIFORNICA S. Wats. (*S. c.* var. *pubescens* Jeps., *S. taxifolia* Standl.). For *S. californica* var. *pubescens*, Dunkle (1940, p. 5) reported: "Forms large clumps in various parts of the mesa". The number and vigor of these populations have declined since 1968. Dry hill-sides, 12 August 1938, *Elmore 302* (AHFH); abundant, sea cliff summits, east side, 28 May 1939, *Dunkle 8114* (AHFH, LAM); mesa slope east of North Peak, 4 May 1963, *Piehl 63-129* (CAS, SBBG), subglabrous; bluff between Cat Canyon and Sutil Island, 22 May 1966, *Philbrick & Benedict B66-417* (CAS, SBBG); few, top of Signal Peak, 4 May 1963, *Blakley 5664* (MICH, RSA, SBBG); west-facing slope between North Peak and Signal Peak, 12 June 1964, *B64-9* (SBBG, SD); summit of North Peak, 21 May 1966, *Philbrick & Benedict B66-382* (RSA, SBBG), very pubescent; common, west terrace near Webster Point, 21 October 1961, *Blakley 4800* (MICH, SBBG); south-facing slope just above sea spray, Sutil Island, 20 March 1968, *B68-85* (MICH, SBBG). Also seen in Cliff Canyon. Specimens differ conspicuously in amount of pubescence.

Nyctaginaceae

MIRABILIS LAEVIS (Benth.) Curran. Restricted to the southern portion of the island. Rare, rock bluff, south end, 28 May 1939, *Dunkle 8107* (LAM); locally common, rocky sea bluffs, south point, 19 March 1940, *Dunkle 7433* (LAM); south-facing slope just east of middle Cat Canyon, 19 March 1968, *B68-80* (RSA, SBBG); few, rocky crevices, west side of Cat Canyon, 4 May 1963, *Blakley 5657* (MICH, SBBG, US).

Aizoaceae

MESEMBRYANTHEMUM CRYSTALLINUM L. [*Cryophytum crystallinum* (L.) N.E. Br., *Gasoul crystallinum* (L.) Rothm.]. See figure 10b in introductory text. Although Dunkle (1940, p. 5) reported *M. crystallinum* as "abundant on all slopes" and "forming large colonies that may be seen as dark patches from many miles at sea", this species now is dominant over even larger portions of the island. See discussion in introductory text. No definite locality, 3 July 1931, *Abrams & Wiggins 307* (DS); abundant, covering large areas, open slope, east side, 30 May 1939, *Dunkle 8146* (AHFH, LAM); common, among *Coreopsis*, many more dead than living plants, slope east of North Peak, 4 May

1963, *Piehl 63-139*; cliff west of Arch Point, common all over the island, 21 October 1961, *Blakley 4793*; lower part of small canyon between Landing Cove and Cliff Canyon, 15 March 1969, *Philbrick & Ricker B69-47*; abundant, forming dense colonies, south side of North Peak, 5 May 1963, *Blakley 5711*; west-facing slope between North Peak and Signal Peak, 12 June 1964, *B64-12*; south-facing slope, rocky ledge just east of summit, Sutil Island, 20 March 1968, *B68-91*. Also seen at Cliff Canyon, Landing Cove, Cave Canyon, Middle Canyon, Cat Canyon, Signal Peak, Webster Point, and rock off Webster Point. The correct generic name for this and the following species is uncertain. Pending a decision involving typification and possibly conservation, the best known name has been used here. "Ice-plant" on Santa Barbara Island was mentioned by Britton (1897, p. 194) and by Grinnell (Pasadena Acad. Sci. Publ. 1:5, 1897). Except for Anacapa and San Nicolas, islands which were not extensively worked by the earlier collectors, *M. crystallinum* was reported for all of the islands from San Miguel to Natividad by the year 1900. *Mesembryanthemum nodiflorum*, on the other hand, spread more slowly.

MESEMBRYANTHEMUM NODIFLORUM L. [*Mesembryanthemum* sp. of Sumner & Bond, 1939; *Cryophytum nodiflorum* (L.) L. Bolus; *Gasoul nodiflorum* (L.) Rothm.]. For *M.* sp., Sumner & Bond (1939, pp. 12-13) indicated "noticeably abundant" or "dominant in some areas". No definite locality, 3 July 1931, *Abrams & Wiggins 289* (DS); dry field, 12 August 1938, *Elmore 310* (AHFH); common, old road, east coast, 28 May 1939, *Dunkle 8121* (AHFH); abundant, open slopes, east side, 30 May 1939, *Dunkle 8147* (AHFH, LAM); few, cliff west of Arch Point, 21 October 1961, *Blakley 4794*; scattered colonies, exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-182*; common in bare areas, ridge top between North Peak and Signal Peak, 5 May 1963, *Blakley 5708*; west-facing slope between North Peak and Signal Peak, 12 June 1964, *B64-13*; south-facing slope, rocky ledge just east of summit, Sutil Island, 20 March 1968, *B68-92*. Also seen at Cat Canyon and Signal Peak. Much less abundant than *M. crystallinum* on this island and less adapted or slower to reach many of the off-shore islands. On the basis of the published record, *M. nodiflorum* reached the Southern California islands of San Nicolas, Santa Catalina, and San Clemente before 1899 but probably did not reach the more northern islands from San Miguel to Santa Barbara until 1930 to 1950. It was reported about the same time, 1932 to 1949, from Guadalupe, San Benito, and Cedros islands but apparently did not reach Los Coronados, Todos Santos, or Natividad until approximately 1968 to 1971 when it was first collected on these three islands by the Santa Barbara Botanic Garden. This plant is not yet known to have been documented from San Martin or San Geronimo. It is probable, therefore, that *M. nodiflorum* is still extending its range in this portion of the world.

Portulacaceae

CALANDRINIA CILIATA var. MENZIESII (Hook.) Macbr. Not reported by Dunkle or Sumner & Bond. To date known only from the northeast portion of the island. Few plants, head of Cliff Canyon, 4 May 1963, *Piehl 63-134*; tops eaten off, rare, rocky ledge, beach bluffs, Landing Cove, 4 May 1963, *Blakley 5688*; east-facing slope, north edge of Landing Cove, 15 March 1969, *Philbrick & Ricker B69-54* (MICH, SBBG, US).

CALANDRINIA MARITIMA Nutt. Found only in the eastern portion of the island. Infrequent, gravelly soil, north ridge, 17 March 1940, *Dunkle 7406* (LAM); one plant, head of Cliff Canyon, 4 May 1963, *Piehl 63-133*; south-facing slope, upper Cave Canyon, 19 March 1968, *B68-67*; between Middle and Graveyard canyons, 19 March 1968, *B68-73*; uncommon, dry rocky soil, southeast bluffs, 19 March 1940, *Dunkle 7432* (LAM). Also seen in Middle and Graveyard canyons.

CLAYTONIA PERFOLIATA Donn [*Montia perfoliata* (Donn) Howell]. Known primarily from the northern portion of the island. Infrequent, rocky shallow soil, north exposure, east canyons, 17 March 1940, *Dunkle 7407* (LAM); common, shady bank, Landing Cove, 21 March 1940, *Dunkle 7457* (LAM); exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-168*; few, north[-facing] slope, rock crevices near center of Cave Canyon, 4 May 1963, *Blakley 5623*. Also seen at Cliff Canyon, Middle Canyon, Graveyard Canyon, North Peak, and West Slope.

Caryophyllaceae

SILENE GALLICA L. Dunkle (1940, p. 5) reported: "Common along the trail from the landing cove"; and this species was not seen beyond that portion of the island until 1970. Infrequent, rocky bluff, east side Landing, 30 May 1939, *Dunkle 8143* (AHFH, LAM); few, shade under *Coreopsis*, beach bluffs, Landing Cove, 4 May 1963, *Blakley 5693*; largest flowers white, 11 mm diameter, smallest flowers pink, 4 mm diameter, probably open pink and age white as petals expand, exposed north-facing slope just above wooden platform, Landing Cove, 21 March 1970, *Philbrick & Benedict B70-32* (RSA, SBBG); with *Microseris*, *Rafinesquia*, *Pholistoma a.* var. *auritum*, north-facing slope, trough of middle-lower Middle Canyon, 22 March 1970, *Philbrick & Benedict B70-48*.

SPERGULARIA MACROTHECA (Hornem.) Heynh. var. MACROTHECA.

Known only from a few locations. Rare, dry terrace, east side, 28 May 1939, *Dunkle 8110* (AHFH); 20 plants seen, east terrace, opposite

Shag Rock, 21 March 1970, *Philbrick & Benedict B70-33*; rare, about 8 plants, bare exposed rocky soil, Arch Point, 5 May 1963, *Blakley 5703* (MICH, SBBG, SD); infrequent, grassy slope, west side, 29 May 1939, *Dunkle 8130* (AHFH, LAM). By transposition of column headings Dunkle (1950, p. 293) accidentally indicated another species of *Spergularia* as occurring on Santa Barbara Island.

Papaveraceae

ESCHSCHOLZIA RAMOSA (Greene) Greene (*E. elegans* Greene of Dunkle, 1942, 1950). For *Eschscholzia elegans*, Dunkle (1942, pp. 128, 131) indicated "not found in recent years or very local". In 1950 (p. 327) he reported: "A single plant on south exposure of Cave Canyon". Now known from both Cave and Graveyard canyons. Rare, arroyo south of east Landing [Cave Canyon], 27 April 1941, *Moran 829* (DS); few plants, south-facing slope, middle Cave Canyon, 18 March 1968, *B68-68*, determined by W. R. Ernst, 1968; south-facing slope, base of small rock cliff below fork in Graveyard Canyon, 27 April 1968, *Philbrick & McPherson B68-229*. According to W. R. Ernst (personal communication, 1968) *E. ramosa* is distinguished from *E. elegans* by its "shorter divisions of the leaves which diverge at a broader angle", by the ultimate leaf divisions which are "more likely to be quite blunt distally", and by the corollas which tend "to be smaller than in *E. elegans*". Both of these taxa are insular endemics, and both occur on Guadalupe Island. *E. elegans* is restricted to that island while *E. ramosa* has been documented for all but four of the islands from Santa Rosa to Cedros (excluding Anacapa, San Nicolas, San Martin, and San Geronimo).

PLATYSTEMON CALIFORNICUS var. CILIATUS Dunkle (*P. ornithopus* Greene of Jepson, *Flora Calif.* 1:557, 1922; *P. aculeolatus* Greene; *P. setosus* Greene). See figure 6 in introductory text. Presently known only from the northeast portion of the island. No definite locality, "only plant found: the flora was mostly seed", May 1901, *Trask s.n.* (CAS 969), type or isotype of *P. aculeolatus*; no definite locality, "infrequent, but many dried plants. fl's cream", May 1902, *Trask 11* (CAS 971, ND-G 3727), type and isotype of *P. setosus*; locally common, gravelly soil, northwest coast, 17 March 1940, *Dunkle 7400* (LAM); common locally, not found elsewhere, head of Cliff Canyon, 4 May 1963, *Piehl 63-130* (MICH, SBBG); few, bare rocky area near beach bluff, Arch Point, 5 May 1963, *Blakley 5700* (CAS, RSA, SBBG, SD, US); down-wind from main population, with *Amsinckia*, between North Peak and mouth of Cliff Canyon, 30 April 1969, *B69-98*. The collections from Santa Barbara Island all represent the same taxon, which is endemic to a portion of this small island. However, the original descriptions of

P. aculeolatus (Greene, Pittonia 5:167, 1903), *P. setosus* (Greene, Pittonia 5:194, 1903), and *P. californicus* var. *ciliatus* (Dunkle, Bull. S. Calif. Acad. Sci. 39:177, 197, 1940) are each inaccurate to a certain degree; they occasionally disagree with the specimens being described or emphasize only a part of the total variation existing in the population. The plants cited above may be described in part as follows: Usually a branched cespitose leafy annual; leaves sparsely ciliate-denticulate, usually with scattered hairs of less than 1 mm on the upper and lower surface; pedicels with similar scattered hairs, less than 7 cm long, usually over-topping the foliage by less than 3 cm; flower diameter 10 to 17 mm; sepals dorsally pubescent to subglabrous; petals white or very light cream; mature fruit torulose, 5 to 11 mm long, with up to 8 joints in each of 8 to 12 carpels. *Platystemon californicus* is a notoriously complex and variable species; however, *P. c.* var. *ciliatus* is distinct both morphologically and geographically.

STYLOMECON HETEROPHYLLA (Benth.) G. Tayl. [*Papaver heterophyllum* (Benth.) Greene of Sumner & Bond, 1939, and Dunkle, 1942, 1950].

Reported by Sumner & Bond (1939, p. 13), otherwise known only from two locations in the northeast portion of the island. North-facing slope, Landing Cove, 28 April 1968, *Philbrick & Thorne B68-240*. Also photographed in upper Cliff Canyon by M. R. Benedict (personal communication, 1971).

Cruciferae

BRASSICA NIGRA (L.) Koch. "One plant along the trail above the cabin" (Dunkle, 1940, p. 6). One plant only, gentle slope, Camp [Landing Cove], 21 March 1940, *Dunkle 7445* (AHFH, LAM). Known only from this collection, which consists of a few shoots (the longest of which is 33 cm), a few small clusters of flower buds, and one flower. Without fruit, the determination is uncertain.

HUTCHINSIA PROCUMBENS (L.) Desv. Not reported by Dunkle or Sumner & Bond. So far known only from one collection in Landing Cove. Shallow soil, level excavated area immediately west of landing platform, Landing Cove, 22 March 1970, *Philbrick & Benedict B70-45*, determined by C. L. Hitchcock, 1970.

LEPIDIUM NITIDUM Nutt. var. NITIDUM. Conspicuous in several scattered locations. Few plants, mesa slope east of North Peak, 4 May 1963, *Piehl 63-124*; dense tufts, base of Arch Point, 4 May 1963, *Piehl 63-141*; common, grassy protected areas near top of Signal Peak, 4 May 1963, *Blakley 5667* (CAS, MICH, RSA, SBBG); few, with weedy

grasses, ridge top between North Peak and Signal Peak, 5 May 1963, *Blakley 5707*; common, hillside, west end, 18 March 1940, *Dunkle 7413* (LAM). Also seen in Graveyard Canyon.

THELYPODIUM LASIOPHYLLUM (H. & A.) Greene var. LASIOPHYLLUM [*Caulanthus lasiophyllum* (H. & A.) Payson]. Not reported by Dunkle or Sumner & Bond, but apparently now spreading throughout the eastern portion of the island. Terrace just north of Landing Cove, near shell mound, 18 March 1968, *B68-24* (MICH, SBBG, US); north rim of lower Graveyard Canyon, 21 May 1966, *Philbrick & Benedict B66-383*; east of Signal Peak, between Graveyard Canyon and Cat Canyon, 19 March 1968, *B68-78*. Also seen in Middle Canyon.

Resedaceae

OLIGOMERIS LINIFOLIA (Vahl) Macbr. (*O. subulata* Del. ex Webb). Reported by Dunkle (1950, p. 311). Now known from scattered locations throughout much of the island, but most conspicuous in the north-east portion. Rare, sun, exposed beach bluff north side of North Peak, 5 May 1963, *Blakley 5704* (SBBG, SD); wind-stunted, just southeast of lighthouse between Arch Point and Cliff Canyon, 18 March 1968, *B68-22*; bluff due west of mouth of Cliff Canyon, 21 May 1966, *Philbrick & Benedict B66-376* (SBBG, US); scattered, northern sea cliff, mouth of Middle Canyon, 5 May 1963, *Piehl 63-157* (CAS, MICH, SBBG); first small canyon north of Graveyard Canyon, 21 May 1966, *Philbrick & Benedict B66-368* (MICH, SBBG); few, bare eroded area near top of Signal Peak, 4 May 1963, *Blakley 5662* (RSA, SBBG); west mesa between Webster Point and Arch Point, 4 May 1963, *Piehl 63-120*. Some doubt has been raised that California is within the native range of *O. linifolia*; however, according to H. C. D. de Wit (personal communication, 1970) *O. linifolia* "very certainly is indigenous in California".

Crassulaceae

CRASSULA ERECTA (H. & A.) Berger (*Tillaea erecta* H. & A.). Noted only in the northern portion of the island. Small dense reddish mats, abundant, beach bluffs, Landing Cove, 4 May 1963, *Blakley 5689*; few, north[-facing] slope, head of Middle Canyon, 4 May 1963, *Blakley 5636*; with *Parietaria*, upper northwest slope of North Peak, 13 February 1970, *B70-3*; common, slope, west end, 18 March 1940, *Dunkle 7411* (LAM). Also seen in Cave Canyon.

DUDLEYA TRASKIAE (Rose) Moran [*Stylophyllum traskae* Rose; *Coty-*

ledon traskae (Rose) Fedde; *Echeveria traskae* (Rose) Berger; *E. greenei* (Rose) Berger of Dunkle, 1940, 1950; *E. albida* (Rose) Berger of Dunkle, 1940, 1942]. See figure 5 in introductory text. Moran (Ph.D. Thesis, Univ. Calif., Berkeley, p. 73, 1951) "saw only two colonies, one on the south slope and one on the west"; Dunkle (1950, p. 328) also reported only these same two populations. Subsequently this plant was found in the eastern canyons; the western population was eliminated prior to 1962. This taxon has been found only on Santa Barbara Island, and it is now thought to be extinct in the wild because all attempts to locate live plants failed in 1970. South-facing slope, lower Cave Canyon, 27 April 1968, *Philbrick & McPherson B68-207*; local and rare, with *Opuntia*, side of Middle Canyon, 22 October 1961, *Blakley 4819*; infrequent, rocky sea bluffs, south end, 28 May 1939, *Dunkle 8102* (LAM); south slope [of Signal Peak], 10 February 1949, *Moran 3158* (SD), grown at Berkeley; west-facing slope west of Cat Canyon, southeast of Signal Peak, 22 May 1966, *Philbrick & Benedict B66-402* (SBBG), *B66-403* (MICH, SBBG); west side, 26-27 April 1941, *Moran 823* (DS, SD). This Santa Barbara Island endemic shows considerable variation in color, shape, and size of the leaves, both in the field and when grown in the garden. However, all of these plants have been determined by Reid Moran as *D. traskiae* and have nearly identical flowers in cultivation. Information on the type follows. ". . . corolla bright canary-yellow, . . . the lobes somewhat spreading; carpels inclined to spread" (Rose, Bull. N.Y. Bot. Gard. 3:34, 1903, part of type description). "Only known from material collected by Blanche Trask on Santa Barbara Island . . ., May, 1901. The plant was distributed as *Cotyledon lanceolata*, from which of course it is very distinct" (Rose, *loc. cit.*, p. 34). "The type specimen consists of fragments from and a photograph of an herbarium specimen. Presumably the original of the photograph was destroyed with the bulk of Mrs. Trask's collections in the San Francisco fire of 1906" (Moran, *loc. cit.*, p. 73).

Leguminosae

ASTRAGALUS TRASKIAE Eastw. [*A. leucopsis* (T. & G.) Torr. of Eastwood, 1941; *A. nevini* Gray of Jepson, Flora Calif. 2:369, 1936, and Eastwood, 1941]. "Common on north and west slopes where wind-swept. There is a very sharp line of demarcation on the summit of the ridge, indicating that it does not like the competition of other plants, particularly the grasses" (Dunkle, 1940, p. 7). Now most conspicuous at bare windy areas between Arch Point and Signal Peak. Reported by Munz (1935, p. 269). No definite locality, 3 July 1931, *Abrams & Wiggins 308* (DS); tufts, bare rocky areas, Arch Point, 5 May 1963, *Blakley 5699* (CAS, MICH, RSA, SBBG, SD, US); prostrate shrub, head of Cliff Canyon, 4 May 1963, *Piehl 63-131* (MICH, SBBG);

common, gravelly soil, north ridge, 17 March 1940, *Dunkle 7405* (AHFH, LAM); forming low mounds, corolla ivory colored, brink of south cliff, 5 May 1941, *Moran 826* (DS), determined by R. C. Barneby; south slope, 350 feet, 26 April 1941, *Moran 822* (UC), grown at Rancho Santa Ana Botanic Garden; south slope, 10 February 1949, *Moran 3158* (UC), grown at Berkeley; tuff, exposed sea bluff, Signal Peak, 19 March 1940, *Dunkle 7436* (AHFH, LAM), abundant where exposed to wind; with *Eriogonum*, summit area, North Peak, 29 April 1969, *B69-72* (SBBG, SD); frequent, cliff summits, west side, 29 May 1939, *Dunkle 8132* (AHFH, LAM); west slope, 350 feet, 27 April 1941, *Moran 823* (UC). Endemic to Santa Barbara and San Nicolas islands and very similar to *A. nevinii*, which is restricted to San Clemente Island. By transposition of column headings Dunkle (1950, p. 293) accidentally indicated two other species of *Astragalus* as occurring on Santa Barbara Island.

LOTUS ARGOPHYLLUS subsp. ORNITHOPUS (Greene) Raven (*Syrmatium ornithopum* Greene). "Occasional on southern bluffs and southern canyon exposures, with one plant on western cliff break" (Dunkle, 1950, p. 328); now quite rare on this island. Ottley (Univ. Calif. Publ. Bot. 10:238, 1923) cites a Trask specimen from Santa Barbara Island. Only eight plants observed, near center of Middle Canyon, 4 May 1963, *Blakley 5639* (MICH, SBBG, US); south-facing slope, lower third of Middle Canyon, 27 April 1968, *Philbrick & McPherson B68-225*; locally common, sea bluff, Signal Peak, 19 March 1940, *Dunkle 7435* (LAM); "Brewster Point" [Webster Point], 18 March 1940, *Dunkle 7409* (LAM). Insular endemic subspecies, reported also from San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. Closely related to mainland taxa and to the more restricted subspecies from Santa Cruz Island (*L. a.* subsp. *niveus*) and from San Clemente Island (*L. a.* subsp. *adsurgens*). The Santa Barbara Island plants are characterized by peduncles which are much shorter than those of the plants from the other four islands where this subspecies occurs.

MEDICAGO POLYMORPHA L. var. POLYMORPHA (*M. hispida* Gaertn.).

For *M. hispida*, Dunkle (1940, p. 6) reported: "Between the cabin and the landing cove." No definite locality, 3 July 1931, *Abrams & Wiggins 313* (DS); common, north exposure, Landing Cove, 21 March 1940, *Dunkle 7463* (AHFH, LAM); north-facing slope, Landing Cove, 28 April 1968, *Philbrick & McPherson B68-239*; few, grassy areas among *Coreopsis*, north slope, Signal Peak, 4 May 1963, *Blakley 5669*. Latter two specimens examined by J. P. Simon. Also seen at North Peak and West Slope. *Medicago polymorpha* occurs on all the islands from San Miguel to San Clemente; but the taxon with only short prickles on the fruit, *M. p.* var. *brevispina*, has been documented only for the larger islands, Santa Rosa, Santa Cruz, Santa Catalina, and San Clemente.

TRIFOLIUM PALMERI S. Wats. [*T. gracilentum* var. *palmeri* (S. Wats.) McDer. of Dunkle, 1940]. For *T. gracilentum* var. *palmeri*, Dunkle (1940, p. 7) reported: "Infrequent on hillsides". Currently scattered in the eastern portion of the island. East-facing slope, terrace between Cave Canyon and North Peak, 29 April 1969, *B69-87* (MICH, SBBG, SD); head of Landing Cove, 30 April 1969, *B69-90*; beach bluff, Landing Cove, 4 May 1963, *Blakley 5690*; cliff of headland just south of Landing Cove, 30 April 1969, *B69-104*; with *Coreopsis*, *Calystegia*, north-facing slope near mouth of Cave Canyon, 30 April 1969, *B69-112*; edge of cactus patch, head of Graveyard Canyon, 21 March 1940, *Dunkle 7449* (LAM); with *Eriogonum*, *Astragalus*, *Malacothrix foliosa*, summit area, North Peak, 29 April 1969, *B69-69*. An insular endemic reported also for San Nicolas (Eastwood, Proc. Calif. Acad. Sci., ser. 3, 1:101, 1898), Santa Catalina, San Clemente, and Guadalupe islands. Distinguishable in the field from *T. tridentatum* by the absence of an involucre and by a preference for drier habitats.

TRIFOLIUM TRIDENTATUM Lindl. (*T. microdon* H. & A. of Dunkle, 1940).

Known only from the eastern portion of the island. Common, bluff, east side, 28 May 1939, *Dunkle 8115* (AHFH, LAM); north-facing slope, Landing Cove, 18 March 1968, *B68-62* (MICH, SBBG); north-facing slope, upper third of Cave Canyon, 27 April 1968, *Philbrick & McPherson B68-220*; common, north exposure, second canyon south [Middle Canyon], 19 March 1940, *Dunkle 7425* (AHFH, LAM); rare, with grass in shade of *Coreopsis*, north slope of Signal Peak, 4 May 1963, *Blakley 5678* (CAS, RSA, SBBG).

Geraniaceae

{ *Erodium botrys* (Cav.) Bertol. "Noticeably abundant" or "dominant in some areas" according to Sumner & Bond (1939, pp. 12-13), who also listed the two documented species of *Erodium* with similar notations for their frequency. This listing was the basis of Dunkle's inclusion of *E. botrys* in 1942 (p. 133) as "rare", and in 1950 (p. 329) as "reported only by Bond". This occurrence not confirmed. }

ERODIUM CICUTARIUM (L.) L'Her. "Noticeably abundant" or "dominant in some areas" (Sumner & Bond, 1939, pp. 12-13). Common, grassy slope, east coast, 28 May 1939, *Dunkle 8120* (AHFH); head of Cliff Canyon, 4 May 1963, *Piehl 63-136*; terrace just north of Landing Cove, near shell mound, 18 March 1968, *B68-26*; common, north open slope, Landing Cove, 21 March 1940, *Dunkle 7462* (AHFH, LAM); few, sun, between Graveyard and Cat canyons, 4 May 1963, *Blakley 5653* (RSA, SBBG); between Cat Canyon and Sutil Island, 22 May, 1966, *Philbrick & Benedict B66-405*; summit of North Peak, 21 May

1966, *Philbrick & Benedict B66-384*; common, summit, open north ridge, 29 May 1939, *Dunkle 8134* (AHFH, LAM). Also seen at Middle Canyon, Graveyard Canyon, Cat Canyon, Signal Peak, and West Slope. The Santa Barbara Island expression of this *Erodium* does not fit any of the subspecies described in the treatment by Webb & Chater (*Flora Europaea* 2:203, 1968). It is characterized by: herbage glandular or non-glandular; leaflets cut about 4/5 of distance to midrib; petals equal or subequal, lavender or nearly white; mericarp 4.3 to 5.4 mm; maximum diameter of apical pit 0.6 to 0.7 mm; single conspicuous or inconspicuous furrow below apical pit.

ERODIUM MOSCHATUM (L.) L'Her. "Noticeably abundant" or "dominant in some areas" (Sumner & Bond, 1939, pp. 12-13); "only found on protected slope in Landing Cove Canyon" (Dunkle, 1940, p. 7). No definite locality, 3 July 1931, *Abrams & Wiggins 301* (DS); common locally, beach bluff, Arch Point, 5 May 1963, *Blakley 5702*; head of Cliff Canyon, 4 May 1963, *Piehl 63-135*; terrace just north of Landing Cove, near shell mound, 18 March 1968, *B68-25*; abundant, open slopes among *Coreopsis*, Camp [Landing Cove], 21 March 1940, *Dunkle 7466* (AHFH, LAM); north-facing slope, upper third of Cave Canyon, 27 April 1968, *Philbrick & McPherson B68-221* (RSA, SBBG); abundant, with *Mesembryanthemum*, side of Cat Canyon, 4 May 1963, *Blakley 5655*. Also seen at Middle Canyon, Signal Peak, North Peak, and West Slope.

Euphorbiaceae

{*Euphorbia misera* Benth. Erroneously indicated as occurring on Santa Barbara Island by Dunkle (1950, p. 294).}

Anacardiaceae

{*Rhus integrifolia* (Nutt.) Benth. & Hook. Accidentally indicated, by transposition of column headings (Dunkle, 1950, p. 293), as occurring on Santa Barbara Island rather than on Santa Catalina. This genus is not known from the former island.}

Rhamnaceae

{*Ceanothus crassifolius* Torr. Erroneously reported as occurring on Santa Barbara Island by Axelrod (Carnegie Inst. Wash. Publ. 516: 119, 1939).}

{*Rhamnus piriifolia* Greene (*R. crocea* var. *insularis* Sarg.). Munz

(1935, p. 299) reported *R. crocea* var. *insularis* for "Catalina and Santa Barbara Is.". This occurrence on Santa Barbara Island is doubtful. }

Malvaceae

{*Lavatera assurgentiflora* Kell. Reported erroneously by Raven (Proc. Symp. Biol. Calif. Islands, p. 62, 1967). }

MALVA PARVIFLORA L. "Occasional on slopes, particularly about former habitations" (Dunkle, 1940, p. 7). No definite locality, 3 July 1931, *Abrams & Wiggins 295* (DS); common, slopes, east side, 28 May 1939, *Dunkle 8117* (LAM); seasonal dominant of patches in grassland, with *Sonchus oleraceus*, seedling *Amblyopappus*, east terrace just north of head of Graveyard Canyon, 13 February 1970, *B70-4*; common, near top of Signal Peak, 4 May 1963, *Blakely 5666* (RSA, SBBG, SD). Also seen at Cliff Canyon, Landing Cove, North Peak, West Slope, Webster Point, and rock off Webster Point.

{*Sidalcea malvaeflora* (DC.) A. Gray ex Benth. Reported by Munz (1935, p. 305) for "... Santa Barbara Is.". This occurrence doubtful. }

Cactaceae

OPUNTIA LITTORALIS (Engelm.) Cockerell. Confused with *O. oricola* in much of the literature prior to 1964. All opuntias were intentionally not collected by Dunkle or Sumner & Bond; undoubtedly this species was present at that time. Large clump, some stem joints semi-spinose, normal flower buds with light pink style and (atypically) without apiculate projections on stigma lobes, aborted flower buds also present, sterile fruit green; with *O. oricola*, *O. prolifera*, *Marah*, *Amblyopappus*; top of sea cliff, east of buildings between Landing Cove and mouth of Cave Canyon, elevation about 175 feet; 21 May 1966; *Philbrick O-628* (MICH, SBBG). Known from all of the islands from San Miguel to Todos Santos, but extremely rare on the former. On Santa Barbara Island it is the least common *Opuntia*, occurring only below 300 feet elevation from Landing Cove to Graveyard Canyon and in Cat Canyon. Distinguished from *O. oricola* by having more elliptical mature stem joints (at least 1.5 times as long as broad), outer perianth parts with entire margins, broader inner perianth parts (less than 1.8 times as long as broad), pink style, and fruit obpyriform (Philbrick, Ph.D. Thesis, Cornell Univ., Ithaca, 1963).

OPUNTIA ORICOLA Philbr. Confused with *O. littoralis* in much of

the literature prior to 1964. Not collected by Dunkle or Sumner & Bond, but present at that time. No definite locality, 3 July 1931, *Abrams & Wiggins 305* (DS); scattered, terrace, Landing Cove, 5 May 1963, *Blakley 5713*; spines straw colored, scattered, most of colony dead, Middle Canyon, 22 October 1961, *Blakley 4818* (SBBG, paratype; MICH); Sutil Island, 20 March 1968, *Philbrick O-703*. Now documented for all the islands from San Miguel to Todos Santos, plus Cedros Island. On Santa Barbara Island it occurs from Cliff Canyon to Cat Canyon. Distinguished from *O. littoralis* by having more circular mature stem joints (less than 1.5 times as long as broad), outer perianth parts with erosely denticulate margins, narrow inner perianth parts (more than 1.8 times as long as broad), red style, and subspherical fruit (Philbrick, *Cactus Succulent J.* 36:163-165, 1964).

OPUNTIA PROLIFERA Engelm. "Infrequent in the *Coreopsis* belt, but small, depauperate forms are plentiful on the bluffs of the south point" (Dunkle, 1940, p. 8). Intentionally not collected by Dunkle or Sumner & Bond. Now especially common on south-facing slopes at lower elevations on the eastern portion of the island. No definite locality, 3 July 1931, *Abrams & Wiggins 306* (DS); 3 feet tall, many young plants around its base, Landing Cove, 5 May 1963, *Blakley 5712*; scattered, semi-shade, north [-facing] slope with *Coreopsis*, Middle Canyon, 22 October 1961, *Blakley 4817* (MICH, SBBG); common, beach bluff south side of Signal Peak, 21 October 1961, *Blakley 4808*; Sutil Island, 20 March 1968, *Philbrick O-704*. Also seen in Cliff, Cave, Graveyard, and Cat canyons. Reported for all the islands from Santa Rosa to Los Coronados, plus San Martin, Guadalupe, San Benito, Cedros, and Natividad; however, several of these populations are conspicuously different and suggest the need for a detailed study.

Onagraceae

CAMISSONIA CHEIRANTHIFOLIA (Hornem. ex Spreng.) Raimann subsp. *CHEIRANTHIFOLIA* (*Oenothera cheiranthifolia* Hornem. ex Spreng. var. *cheiranthifolia*). Known only from one collection, which P. H. Raven (personal communication, 1970) has suggested might possibly be in error. However, an appropriate northwest beach habitat was known to D. O. Hyder (personal communication, 1970) as late as 1926. No definite locality, no date, *Henry Hemphill s.n.* (UC 172325), "Brandege Herbarium", determined by P. A. Munz in August 1927, determined by P. H. Raven in 1966-1967. Specimen consists of one small seedling plus three separate branches (17-23 cm long); each portion is with flowers or fruit. Hemphill collected on Anacapa Island in 1901.

Umbelliferae

DAUCUS PUSILLUS Michx. Not reported by Dunkle or Sumner & Bond. To date known only from Landing Cove. Rare, shade under *Coreopsis*, beach bluffs, Landing Cove, 4 May 1963, *Blakley 5687*; north-facing slope, Landing Cove, 28 April 1968, *Philbrick & McPherson B68-238*.

Convolvulaceae

CALYSTEGIA MACROSTEGIA (Greene) Brummitt subsp. MACROSTEGIA (*Convolvulus occidentalis* var. *macrostegius* Munz). For *Convolvulus occidentalis* var. *macrostegius*, Dunkle (1940, p. 8) reported: "Common about the island, especially in the *Coreopsis* belt". Now primarily confined to the eastern canyons. No definite locality, 3 July 1931, *Abrams & Wiggins 296* (DS), determined by S. M. Walters & D. A. Webb, 1960; occasional, brushy slopes, east side, 29 May 1939, *Dunkle 8138* (LAM); scandent vine visited by bees and beetles, slopes near center of Cave Canyon, 4 May 1963, *Blakley 5622*; scandent on *Coreopsis*, few, mouth of Cave Canyon, 21 October 1961, *Blakley 4804* (CAS, SBBG); north-facing slope, upper Middle Canyon, 22 May 1966, *Philbrick & Benedict B66-408*; with *Stipa*, *Amblyopappus*, *Opuntia prolifera*, upper Graveyard Canyon, 19 March 1968, *B68-84*; heavy woody base, corolla cream with light purple outside, near head of Graveyard Canyon, 5 May 1963, *Piehl 63-165*. These morning-glories are considered here as an insular endemic subspecies (see Brummitt, *Ann. Missouri Bot. Gard.* 52:214-216, 1965) occurring on all of the islands from San Miguel to San Clemente, plus San Martin and Guadalupe. They are morphologically approached by certain plants of a closely related subspecies from the Santa Barbara-Carpinteria area of the mainland. The insular taxon differs by having large coreaceous leaves, thick stems, long peduncles with several flower buds each, large flowers, large bracts, and pollen grains of 80 to 116 microns (vs. 80 to 88 microns for the Santa Barbara-Carpinteria plants). The genus should be more closely studied on Santa Catalina Island where both insular and mainland taxa occur.

Polemoniaceae

GILIA NEVINII A. Gray [*G. gilioides* (Benth.) Greene of Dunkle, 1940, 1950]. For *G. gilioides*, Dunkle (1940, p. 8) reported: "Very rare and occurring only in a depauperate state on grassy slopes. Identification uncertain." Now known from several locations in and near the eastern canyons. East-facing slope, north edge of Landing Cove, 15 March 1969, *Philbrick & Ricker B69-51*; corolla lavender, trail from shore,

Landing Cove, 5 May 1963. *Piehl* 63-178; rare, shaded side, second canyon south [Middle Canyon], 19 March 1940, *Dunkle* 7429 (LAM), as *G. gilioides*; flower purplish, anthers blue, rare, rocky north [-facing] slope near junction of forks, Graveyard Canyon, 4 May 1963, *Blakley* 5650; north-facing slope, second small canyon south of Graveyard Canyon, 28 April 1968, *Philbrick & McPherson* B68-243b. This insular endemic occurs on Santa Cruz, Anacapa, Santa Barbara, Santa Catalina, San Clemente, and Guadalupe islands. The occurrence on the latter three islands has been previously recognized (Munz, 1935, p. 394; Grant, *Aliso* 6:72, 1966); and the occurrence on the more northern three islands is based on specimens at the Santa Barbara Botanic Garden, including: *Philbrick, Benedict & Smith* B65-713, B65-730, B65-785, 20-21 April 1965; *Blakley* 4950, 4975, 4984, 31 March & 1 April 1962, determined by Alva Day in August 1963; *Philbrick* B65-517, B65-525, 28 March 1965. As are many gillias, this species is somewhat difficult to identify. We have emphasized the following characters in distinguishing it from related species: maximum plant size larger than *G. angelensis*, stem pubescent throughout, leaf 2- to 3-pinnate, calyx narrow-cylindrical, corolla relatively large and lavender at base, pollen marked with meandering non-geometric lines.

Hydrophyllaceae

PHACELIA DISTANS Benth. approaching *P. FLORIBUNDA* Greene (*P. distans* Benth. of *Dunkle*, 1940; *P. floribunda* Greene of *Dunkle*, 1942, 1950; *P. hispida* Gray of *Eastwood*, 1941, and *Dunkle*, 1942, 1950). In and near the eastern canyons. No definite locality, 3 July 1931, *Abrams & Wiggins* 298 (DS, UC); no definite locality, 14 May 1940, *Bond s.n.* (UC 637185); infrequent, north slope, east coast, 28 May 1939, *Dunkle* 8122 (LAM); mesa slope east of North Peak, 4 May 1963, *Piehl* 63-122 (CAS, SBBG); fairly common, south exposure, Landing Cove, 21 March 1940, *Dunkle* 7460 (LAM); arroyo south of east Landing [Cave Canyon], 27 April 1941, *Moran* 828 (UC); common, shaded bottom, second canyon south [Middle Canyon], 20 March 1940, *Dunkle* 7441 (AHFH, LAM); terrace just south of lower Middle Canyon, 15 March 1969, *Philbrick & Ricker* B69-37; infrequent in few colonies, open gentle slope above head of Graveyard Canyon, 5 May 1963, *Piehl* 63-164; bottom of lower Graveyard Canyon, 27 April 1968, *Philbrick & McPherson* B68-233; east-facing slope, head of first small gully south of Graveyard Canyon, 28 April 1968, *Philbrick & McPherson* B68-244. This *Phacelia* forms a series of somewhat variable populations on Santa Barbara Island. Although a few plants in the drier locations (*Philbrick & Ricker* B69-37) exhibit the consistently pinnatifid sepals of *P. floribunda* (as known from Guadalupe and San Clemente islands), even these individuals have larger seeds and longer anthers than are characteristic

of the insular species. The Santa Barbara Island plants have: a variable proportion of glandular hairs on the stem (all less glandular than *P. floribunda* and insular *P. distans*), variable sepals (from all sepals entire to one few-lobed sepal per flower, to all pinnatifid sepals), dried anther lengths of 0.6 to 1.0 mm, and mature seeds of 1.7 to 2.5 mm in length. Particular attention should also be given to the shape and attachment position of the scales at the base of the anthers. The relationship between *P. floribunda* and *P. distans* is worthy of detailed study on this island.

PHOLISTOMA AURITUM (Lindl. ex Lindl.) Lilja var. *AURITUM*. Not reported by Dunkle or Sumner & Bond. To date known only from Cave and Middle canyons. Bottom, upper Cave Canyon, 16 March 1969, *Philbrick & Ricker B69-57, B69-58*; north-facing slope, middle Cave Canyon, 19 March 1968, *B68-69*; with *Phacelia*, trough just below dry falls, middle Middle Canyon, 22 March 1970, *Philbrick & Benedict B70-56* (RSA, SBBG); with *Silene*, *Microseris*, *Rafinesquia*, north-facing slope, trough of middle-lower Middle Canyon, 22 March 1970, *Philbrick & Benedict B70-51*.

PHOLISTOMA RACEMOSUM (Nutt.) Const. (*Nemophila racemosa* Nutt. ex A. Gray). Known only from the eastern canyons. Trail from east Landing, 27 April 1941, *Moran 832* (CAS); few, trough of Cave Canyon, 5 May 1963, *Piehl 63-150* (SBBG, US); south-facing slope lower Middle Canyon, 19 March 1968, *B68-74*; locally common, shaded bottom, Graveyard Canyon, 20 March 1940, *Dunkle 7443* (LAM).

Boraginaceae

AMSINCKIA INTERMEDIA F. & M. (*A. spectabilis* F. & M. of Dunkle, 1940). Sumner & Bond (1939, pp. 12, 14) indicated "noticeably abundant" or "dominant in some areas". Dunkle (1940, p. 9) reported *A. spectabilis* as "occasional on grassy slopes"; however, in 1942 he (Dunkle, pp. 128, 134) indicated *A. intermedia* as "abundant" or "usually dominant". Both of Dunkle's observations probably refer to *A. intermedia*, which is now common throughout much of the island. No definite locality, 14 April 1939, *Bond 383* (SBM); common, grassy terrace, east side, 28 May 1939, *Dunkle 8112* (LAM); prostrate, flowers orange, scattered, Cliff Canyon, 5 May 1963, *Blakley 5697* (RSA, SBBG); common, open slopes, Landing Cove, 21 March 1940, *Dunkle 7461* (LAM), as *7451* in Dunkle (1940, p. 9); very prickly, corolla yellow, some with orange spots, Landing Cove, 5 May 1963, *Piehl 63-171*; flowers orange, common, head of Cave Canyon, 4 May 1963, *Blakley 5615* (SBBG, SD); southwest-facing slope just east of Sutil Island, 16 March 1969, *Philbrick & Ricker B69-59*, also very conspicuous over nearly all of east slope; flowers orange, common, grassy area

south side of North Peak, 5 May 1963, *Blakley 5710* (MICH, SBBG); low, somewhat decumbent, corolla small, yellow, among *Coreopsis*, slope east of North Peak, 4 May 1963, *Piehl 63-138*; prostrate, exposed to strong wind, common, north side of North Peak, 5 May 1963, *Blakley 5705* (CAS, SBBG); with *Suaeda*, *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Hordeum glaucum*, *Lasthenia*, north base of Webster Point peninsula, 29 April 1969, *B69-76*. Also seen at Arch Point, Middle Canyon, Graveyard Canyon, Cat Canyon, and Signal Peak. Above determinations verified by E. R. Chandler. The following characteristics are useful in distinguishing this species from *A. spectabilis*. The calyx lobes are always free, while at least one pair is frequently united in *A. spectabilis*. The mature nutlet is usually greater than 2.5 mm in length, has pronounced irregular ridges and tubercles on its dorsal surface and a transverse ventral keel that intersects an ovate attachment scar above its widest point (Ray & Chisaki, *Amer. J. Bot.* 44:530, 1957).

AMSINCKIA SPECTABILIS F. & M. The two collections, which Dunkle (1940, p. 9) cited for *A. spectabilis*, are *A. intermedia*. More delicate habit than *A. intermedia*, two to three calyx lobes united for more than half their length, homostylic, locally common, terrace about 40 feet west of sea cliff, just west of Arch Point, 21 March 1970, *Philbrick & Benedict B70-34* (RSA, SBBG).

CRYPTANTHA CLEVELANDII Greene var. **CLEVELANDII** [*C. traskae* Johnston of Dunkle, 1940; *C. c.* var. *hispidissima* (Greene) Johnston of Dunkle, 1940; *C. c.* var. *florosa* Johnston.; *C. leiocarpa* (F. & M.) Greene of some authors; *C. brandegei* Johnston.; *C. abramsii* Johnston.]. Reported as *C. clevelandii* and in error as *C. traskae* by Dunkle (1940, p. 9). Apparently confined to the eastern portion of the island. No definite locality, 14 April 1939, *Bond 386* (SBM); Landing Cove, 21 March 1940, *Dunkle 7446-b* (AHFH), as *C. traskiae* [corrected spelling]; common, south[-facing] slope, head of Cave Canyon, 4 May 1963, *Blakley 5613* (CAS, SBBG, SD); uncommon, shaded side, second canyon south [Middle Canyon], 19 March 1940, *Dunkle 7428* (LAM); common locally, cactus clump, head of Graveyard Canyon, 21 March 1940, *Dunkle 7447* (LAM); rare, rocky bluffs, south end, 28 May 1939, *Dunkle 8106* (AHFH); uncommon, gravelly soil, Signal Peak, 21 March 1940, *Dunkle 7446* (LAM), as *C. traskiae*; among *Coreopsis*, slope east of North Peak, 4 May 1963, *Piehl 63-140* (SBBG, SD); common, exposed to strong wind, north side of North Peak, 5 May 1963, *Blakley 5706* (CAS, MICH, RSA, SBBG). According to E. R. Chandler (personal communication, 1969) *C. clevelandii* seems to be composed of several morphologically distinct ecological races. The Santa Barbara Island material is similar to that from the mainland coast of Ventura. For this taxon, the habit of growth is sprawling to subprostrate

with relatively thin stems; the mature stem pubescence is composed of both thin short appressed hairs without pustulate bases and longer stouter spreading hairs with pustulate bases; some of the inflorescences have a few bracts toward their bases; the larger hairs on the midrib of the mature calyx lobes are relatively few and usually from 1.5 to 2.0 mm in length; the flower is relatively small (maximum corolla diameter 1.7 to 2.3 mm); the combined height of style and gynobase does not exceed that of the mature nutlet (0.7 to 0.8 times nutlet height).

{*Cryptantha intermedia* (A. Gray) Greene. Reported by Dunkle (1942, p. 134; 1950, p. 330) without voucher specimen; this occurrence is doubtful.}

CRYPTANTHA MARITIMA (Greene) Greene. Johnston (Contr. Gray Herb., *n.s.*, 74:48, 1925) cites a Trask specimen from Santa Barbara Island as *C. maritima* var. *genuina*. Currently restricted to the eastern portion of the island. Scattered, Cliff Canyon, 5 May 1963, *Blakley 5694*; terrace just north of Landing Cove, near shell mound, 18 March 1968, *B68-28*; rocky ledges, mouth of Cave Canyon, 4 May 1963, *Blakley 5628* (MICH, SBBG, SD); common, rocky ledges, mouth of Middle Canyon, 4 May 1963, *Blakley 5646*; between Middle and Graveyard canyons, 19 March 1968, *B68-72*; with *Amblyopappus*, *Opuntia prolifera*, *Calandrinia maritima*, dry exposed southeast-facing slope, upper Graveyard Canyon, 19 March 1968, *Philbrick s.n.* (SBBG 29583); infrequent, rocky bluffs, cliffs, south end, 17 March 1940, *Dunkle 7403* (AHFH, LAM); east-facing slope, mouth of Cat Canyon, 28 April 1968, *Philbrick & McPherson B68-245*; bluff between Cat Canyon and Sutil Island, 22 May 1966, *Philbrick & Benedict B66-415*. The relationship to mainland taxa and to *C. cedrosensis* is under study.

Solanaceae

LYCIUM CALIFORNICUM Nutt. ex A. Gray. "Widespread and frequently dominant on all terraces, southern bluffs, and western headlands; frequently a component of the *Suaeda-Larus* biome" (Dunkle, 1950, p. 330). Presently scattered over much of the island, but most of the stands are thin and small. Gradually disappearing from many of the California off-shore islands. Thickets about 12 inches high, dry fields, 12 August 1938, *Elmore 295* (AHFH); common, slopes, east side, 28 May 1939, *Dunkle 8125* (AHFH); scattered colonies 2 feet tall, east terrace, 21 October 1961, *Blakley 4809*; south-facing slope, middle Cave Canyon, 21 May 1966, *Philbrick & Benedict B66-363* (SBBG, SD); 2 feet by 4 feet, scattered, ridge between North Peak and Signal Peak, 5 May 1963, *Blakley 5709* (MICH, RSA, SBBG); with *Amsinckia*, *Amblyopappus*, *Hordeum glaucum*, *Mesembryanthemum nodiflorum*, *M. crystal-*

linum, rocky west-facing slope, north base of Webster Point peninsula, 29 April 1969, *B69-80*; abundant, flat terrace, west end, 18 March 1940, *Dunkle 7418* (LAM); rocks, southwest-facing slope, west terrace near southwest coast, between the Hook and *Suaeda* swale, 29 April 1969, *B69-83*; west ridge, Sutil Island, 20 March 1968, *B68-87*. Also seen at Cliff Canyon, Middle Canyon, Landing Cove, and Webster Point.

Scrophulariaceae

GALVEZIA SPECIOSA (Nutt.) A. Gray. Known only from the following fragmentary specimen, which was brought to our attention by Roman Gankin and L. R. Heckard. No definite locality, "plant from Santa Barbara I.," May 1863, *J. G. C[oooper] s.n.* (UC 26766). Specimen consists of a total of 16 cm of inflorescence. The lower portion has four subglabrous leaves; the upper has three corollas. This taxon is an insular endemic known otherwise only from Santa Catalina and San Clemente islands. A similar taxon is known from Guadalupe Island, but the Guadalupe plant differs in frost hardiness, habit of growth, and characters of the leaf, flower, and fruit. Detailed study will undoubtedly show the latter taxon to constitute a distinct subspecies. J. G. Cooper made zoological collections on Santa Barbara Island for six weeks in May and June 1863 (Cooper, Proc. Calif. Acad. Sci. 4:80, 1870; Howell, 1917, p. 20); and his specimen indicates a logical range extension from the larger, floristically related southern islands. The Cooper collection is dated 38 years before the next known botanical specimens were taken from the island, and it seems quite possible that *Galvezia* might have become extinct or extremely rare during those years. Although there is no doubt about the identification of the specimen and the label information is accepted here as originally given, it should be mentioned that the collection data might possibly have been confused; for at about the same time Cooper also visited Santa Catalina and San Clemente islands (Howell, 1917, pp. 25, 55, 78), and his specimen matches material from either of these islands. It may be relevant that the accuracy of Cooper's zoological collection data is placed in some doubt by Howell (1917, p. 6) and by reference to Cooper's own list of island fauna (Cooper, Proc. Calif. Acad. Sci. 4:77, 1870).

Plantaginaceae

{*Plantago maritima* L. Reported by Dunkle (1942, p. 135) without documenting specimen, and omitted from his more comprehensive 1950 publication. This occurrence is doubtful.}

PLANTAGO OVATA Forssk. (*P. insularis* Eastw.). Known only from

the southern portion of the island. Near cliff just north of mouth of Graveyard Canyon, 22 March 1970, *Philbrick & Benedict B70-58*; common locally, exposed rocky sea bluff, southeast point, 19 March 1940, *Dunkle 7430* (LAM); west-facing slope, upper Cat Canyon, 19 March 1968, *B68-79*; few, scattered among rocks and *Opuntia prolifera*, between Cat Canyon and Signal Peak, 4 May 1963, *Blakley 5658* (DS, SBBG); few, edge of bare spots near top of Signal Peak, 4 May 1963, *Blakley 5661* (DS, MICH, SBBG). Morphological and palynological studies indicate that *P. ovata* of the Old World and *P. insularis* of North America are conspecific, the American populations being introduced (Bassett & Baum, Can. J. Bot. 47:1865-1868, 1969). For cytogenetic evidence emphasizing the differences between these two populations, see Stebbins & Day (Evolution 21:409-428, 1967).

Rubiaceae

{*Galium angustifolium* Nutt. Munz (1959, p. 1043) reported *G. angustifolium* var. *foliosum* for “. . . Santa Cruz, Santa Rosa, Anacapa, Santa Barbara ids.”. The possible primary sources suggested by P. A. Munz (personal communication, 1969) have been checked without giving evidence of any *Galium*, other than *G. aparine*, on Santa Barbara Island. It is possible that the above quote was intended to mean “on Santa Cruz, Santa Rosa, and Anacapa of the Santa Barbara Islands”. *Galium angustifolium* var. *foliosum* is known only for the more northern islands, Santa Rosa, Santa Cruz, and Anacapa; the tetraploid, *G. a.* var. *angustifolium*, occurs on Santa Catalina Island (Lauramay T. Dempster, personal communication, 1969). The occurrence of either of these varieties on Santa Barbara Island is doubtful. }

GALTIUM APARINE L. Low cropped-off plant, mesa slope east of North Peak, 4 May 1963, *Piehl 63-123*; exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-169* (CAS, SBBG), frequent on east side of island; scattered, scandent on grass, base of cliff, north [-facing] slope, mouth of Cave Canyon, 4 May 1963, *Blakley 5632*, determined by L. T. Dempster; few, scandent below rocky cliff, north [-facing] slope near junction of north and south forks, Graveyard Canyon, 4 May 1963, *Blakley 5648* (CAS, MICH, SBBG, US), determined by L. T. Dempster; common, with *Lycium*, flat terrace, west end, 18 March 1940, *Dunkle 7417* (AHFH, LAM). Also seen in Middle Canyon.

Cucurbitaceae

MARAH MACROCARPUS (Greene) Greene (*Echinocystis fabacea* Naud. of Dunkle, 1940; *E. macrocarpa* Greene). Known only from the

eastern portion of the island. No definite locality, 14 April 1939, *Bond 401* (SBM); small canyon between Landing Cove and Cliff Canyon, 18 March 1968, *B68-37* (MICH, SBBG); bluff, Landing Cove, 4 May 1963, *Blakley 5686* (SBBG, SD); common, first canyon south [Cave Canyon], 20 March 1940, *Dunkle 7439* (LAM); sea cliff north of North Peak, 21 May 1966, *Philbrick & Benedict B66-380*. Also seen in Cliff, Middle, Graveyard, and Cat canyons. On the basis of Stocking's publication (Madroño 13:113-137, 1955) and study of the specimens at the California Academy of Sciences, Santa Barbara Museum of Natural History, and Santa Barbara Botanic Garden, E. R. Chandler (personal communication, 1969) has considered the following characteristics of *M. macrocarpus* in distinguishing it from *M. jabaceus*: flowers larger, more or less cup-shaped; small free tips of calyx usually projecting between corolla lobes; filaments usually longer than anthers; scale-like staminodia usually present; stigmas rounded; styles evident. Variation and relationship within and between the species are being studied further.

Compositae

ACHILLEA BOREALIS Bong. [*A. millefolium* var. *lanulosa* (Nutt.) Piper of Dunkle, 1940, 1942, 1950; *A. lanulosa* Nutt. of Eastwood, 1941]. For *A. millefolium* var. *lanulosa*, Dunkle (1940, p. 11) reported: "Common about the island. It grows very short and compact on the inaccessible north cliffs . . ." Still scattered throughout much of the island. No definite locality, 3 July 1931, *Abrams & Wiggins 294* (DS), determined as *A. borealis* subsp. *californica* (Pollard) Keck by F. Ehrendorfer, 1952; dry hillside, 12 August 1938, *Elmore 308* (AHFH); common, north slopes, east side, 28 May 1939, *Dunkle 8118* (AHFH); to 1 foot tall, scattered, rocky beach bluff with *Coreopsis*, Landing Cove, 21 October 1961, *Blakley 4788* (RSA, SBBG); scattered in grass, north [-facing] slope near center of Middle Canyon, 4 May 1963, *Blakley 5645*; to 14 inches tall, scattered, grassy north slope of Signal Peak, 4 May 1963, *Blakley 5671* (MICH, SBBG); with *Coreopsis*, *Amsinckia intermedia*, *Thelypodium*, *Malacothrix foliosa*, *Hordeum glaucum*, east-facing slope, North Peak, 29 April 1969, *B69-66*. Also seen on East Slope and West Slope. For a discussion of the subspecies of *A. borealis* see Clausen, Keck, & Heisey (Carnegie Inst. Wash. Publ. 520:298-299, 1940). Treated as varieties of *A. millefolium* by Nobs (*In Abrams & Ferris, Illus. Flora Pacific States 4:390-391, 1960*).

AMBLYOPAPPUS PUSILLUS H. & A. Common throughout much of the island. No definite locality, 14 April 1939, *Bond 371* (SBM); no definite locality, 14 May 1940, *Bond 508* (SBM); common, widely distributed, grassy terrace, east side, 28 May 1939, *Dunkle 8111* (AHFH, LAM);

bluff half-way between Landing Cove and Cliff Canyon, 21 May 1966, *Philbrick & Benedict B66-372*; few, under *Coreopsis*, shady beach bluff, Landing Cove, 22 October 1961, *Blakley 4813* (RSA, SBBG); vigorous erect plants, near buildings just south of Landing Cove, 22 May 1966, *Philbrick & Benedict B66-412* (MICH, SBBG), 32 cm high; sea bluffs, south end, 19 March 1940, *Dunkle 7434* (LAM); common, bare areas, north slope of Signal Peak, 4 May 1963, *Blakley 5676*; summit area, North Peak, 29 April 1969, *B69-71*; bluff due north of North Peak, 21 May 1966, *Philbrick & Benedict B66-379*. Also seen at Cliff Canyon, Middle Canyon, Graveyard Canyon, West Slope, and Webster Point.

{*Ambrosia chamissonis* (Less.) Greene. Indicated as occurring on Santa Barbara Island by Foreman (1967, p. 70). This occurrence is doubtful.}

ARTEMESIA CALIFORNICA var. INSULARIS (Rydb.) Munz (*A. nesiotica* Raven). Scattered in the eastern portion of island. No definite locality, 3 July 1931, *Abrams & Wiggins 299* (DS, UC); common, lower terrace slope, east side, 28 May 1939, *Dunkle 8126* (AHFH, LAM); eastern slope between Cave and Middle canyons, 19 March 1968, *B68-70* (SBBG, US); mesic habitate with *Mesembryanthemum crystallinum*, rocky northeast-facing slope south of Landing Cove, 30 April 1969, *B69-106*; scattered, sun, mouth of Cave Canyon, 21 October 1961, *Blakley 4802* (MICH, SBBG), *4803* (SBBG, SD); 3 feet tall, 4 feet in diameter, few, head of Middle Canyon, 4 May 1963, *Blakley 5647*; top of cliff, south of Signal Peak, opposite Sutil Island, 22 May 1966, *Philbrick & Benedict B66-407* (RSA, SBBG). An insular endemic also occurring on San Nicolas and San Clemente islands. Plants of *B68-70* grown at Santa Barbara Botanic Garden have up to 12 ray flowers and 35 disk flowers per head.

BACCHARIS PILULARIS subsp. CONSANGUINEA (DC.) C. B. Wolf. Listed for terraces of Santa Barbara Island by Dunkle (1950, p. 292) but no documenting specimen found and not included in his "Annotated List of the Vascular Plants of Santa Barbara Island" (1950, pp. 326-331). Now known only from a single shrub in Middle Canyon. Single plant, south edge of canyon bottom, lower third of Middle Canyon, just above point where canyon narrows, 27 April 1968, *Philbrick & McPherson B68-224* (CAS, MICH, SBBG, SD).

CENTAUREA MELITENSIS L. Not reported by Dunkle or Sumner & Bond; so far found only in the Landing Cove area. Rosettes only, exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-176* (SBBG); north of buildings, south of Landing Cove, 28 April 1968, *Philbrick & McPherson B68-235* (RSA, SBBG).

COREOPSIS GIGANTEA (Kell.) Hall. See figures 11a–12a in introductory text. About 1871 Kellogg or Harford noted “This plant is . . . found on Santa Barbara Island, in some ravines, reaching to 10 feet in height; on exposed cliffs and plateaus it rarely exceeded 5 feet . . .” (Proc. Calif. Acad. Sci. 4:199, 1873). In 1940 Dunkle (p. 10) reported: “The most characteristic growth on the island. Grotesque and tree-like, much more arborescent than the plants elsewhere, growing from 4 to 8 feet high with stout branches at right angles. It forms dense thickets on the east slopes and bluffs from 30 to 250 feet. It is scattered elsewhere over the island. On the north bluffs the Pelicans use the stubby plants as a foundation for their high nests.” In 1950 he referred to this species as “the dominant plant of the island” (p. 279) and added: “Common in all but the most extremely wind-swept areas; dominant on the lower eastern terrace, bluffs, and canyons. Undoubtedly dominant over more extensive areas before cultivation of the terraces” (p. 330). This plant is now reduced to scattered, relatively thin patches within the distribution described here. See introductory text and figure 9 for further details of distribution. No definite locality, August 1901, *Snodgrass s.n.* (DS 492439); dry canyon walls and rocky hillsides, 12 August 1938, *Elmore 297* (AHFH); with *Mesembryanthemum crystallinum* (dominant), *Perityle*, *Atriplex semibaccata*, *Opuntia prolifera*, *Chenopodium murale*, *Sonchus oleraceus*, *Malacothrix foliosa*, *Amblyopappus*, *Amsinckia*, *Malva*, south-facing slope, lower-middle Cliff Canyon, 30 April 1969, *B69-94*; extremely abundant, open gentle slope, Camp [Landing Cove], 21 May 1940, *Dunkle 7444* (AHFH, LAM); 4 to 8 feet high, near Landing, 10 February 1949, *Moran 3161* (DS, SD, UC), “. . . forming forest over much of east slope of island”; 3 feet tall, common, beach bluffs, Landing Cove, 4 May 1963, *Blakley 5692* (MICH, SBBG); gnawed by rabbits, with *Trifolium palmeri*, *Malacothrix foliosa*, headland cliff just south of Landing Cove, 30 April 1969, *B69-103*; 1 to 2 meters tall, 2 to 4 inches diameter at breast height, rocky north-facing slope, lower Cave Canyon, 27 April 1968, *Thorne 37529* (SD); waist high, dominating small open *Coreopsis* patch, with *Bromus rubens*, *Hordeum glaucum*, *Atriplex semibaccata*, *Thelypodium*, *Amsinckia intermedia*, *Achillea*, *Malacothrix foliosa*, seedling *Coreopsis*, east-facing slope, North Peak, 29 April 1969, *B69-64*; common, north slope, North Peak, 1 October 1961, *Blakley 4798*; extremely common, ridge above sea, northwest side, 29 May 1939, *Dunkle 8129* (AHFH, LAM).

ERIOPHYLLUM NEVINII A. Gray. Primarily confined to the less accessible sea cliffs. Dry hillside, 12 August 1938, *Elmore 300* (AHFH); few, upper beach bluff west of Arch Point, 21 October 1961, *Blakley 4797* (CAS, RSA, SBBG, SD); rocks near east Landing, 27 April 1941, *Moran 883* (DS); east-facing slope, first small gully south of Landing Cove, east of Quonset huts, 30 April 1969, *B69-101* (MICH, SBBG); to 12 inches tall, south[-facing] slope, windswept rocky ledge, mouth of

Cave Canyon, 4 May 1963, *Blakley 5629* (MICH, SBBG, US); rocky sea bluffs, south end, 28 May 1939, *Dunkle 8101* (LAM); common, sea cliffs, "northwest rock" [there is no other known evidence that Dunkle might have collected on Shag Rock], 28 May 1939, *Dunkle 8128* (LAM); west ridge, Sutil Island, 20 March 1968, *B6888*. Endemic to Santa Barbara, Santa Catalina, and San Clemente islands. Each of the three populations is modally distinct, at least in characteristics of the foliage.

{*Gnaphalium purpureum* L. Reported by Munz (1935, p. 541) for ". . . Santa Barbara and Santa Rosa I." and by Munz (1959, p. 1259) for ". . . Santa Catalina, Santa Rosa, and Santa Barbara ids.". No other evidence is known; a documenting specimen has not been seen for Santa Barbara Island. }

{*Haplopappus venetus* (HBK.) Blake [*Aplopappus venetus* (HBK.) Blake]. By transposition of column headings for Santa Catalina and Santa Barbara islands Dunkle (1950, p. 293) accidentally indicated two varieties of *Aplopappus venetus* as occurring on Santa Barbara Island. This genus is not known from the latter island. }

HEMIZONIA CLEMENTINA Brandeg. (*H. c.* "forma erecta" of Dunkle, 1950, *H. c.* "forma prostrata" of Dunkle, 1950). "*Astragalus traskiae*, *Malacothrix foliosa*, *Hemizonia clementina*, and *Baeria hirsutula* are dominants of the windiest areas" (Dunkle, 1950, p. 274). Hall (Univ. Calif. Publ. Bot. 3:150-151, 1907) cited the Trask specimen from Santa Barbara Island. Presently throughout much of the island. No definite locality, no date, *Trask s.n.* (UC 89558); no definite locality, August 1901, *Snodgrass s.n.* (DS 492422); narrow-leaved form, no definite locality, 3 July 1931, *Abrams & Wiggins 300* (DS); no definite locality, 3 July 1931, *Abrams & Wiggins 302* (DS, UC); dry hillside, 12 August 1938, *Elmore 299* (AHFH); abundant, rocky sea cliffs, east side, 28 May 1939, *Dunkle 8113* (LAM), maximum cauline leaf length 8.4 cm; to 1 foot tall, few, under *Coreopsis*, north[-facing] slope, Landing Cove, 21 October 1961, *Blakley 4790* (CAS, SBBG), maximum cauline leaf length 1.7 cm; to 1 foot tall, few, under *Coreopsis*, Middle Canyon, 22 October 1961, *Blakley 4822* (RSA, SBBG); abundant, sea bluffs, south end, 19 March 1940, *Dunkle 7437* (AHFH, LAM); 1 foot tall, 2 feet in diameter, scattered, between Cat Canyon and Signal Peak, 4 May 1963, *Blakley 5660*; 2 feet in diameter, scattered, north slope of Signal Peak, 4 May 1963, *Blakley 5672*; 6 inches high, 11 inches in diameter, summit of North Peak, 21 May 1966, *Philbrick & Benedict B66-381* (SBBG, SD); prostrate, bluff due north of North Peak, 21 May 1966, *Philbrick & Benedict B66-377*; 1 foot tall, few, west terrace near Webster Point, 21 October 1961, *Blakley 4799* (SBBG, US). An insular endemic species reported also from Anacapa, San Nicolas, Santa

Catalina, and San Clemente islands. Its nearest relatives are probably the species of the Baja California off-shore islands (see Carlquist, *Island Life*, pp. 115–118, 1965). Both the size and shape of leaf and the pubescence of herbage are conspicuously modified by time of year and by habitat.

HEMIZONIA FASCICULATA (DC.) T. & G. subsp. FASCICULATA [*H. f.* var. *ramosissima* (Benth.) Gray of Eastwood, 1941, and Dunkle, 1942, 1950]. To date known only from the northeast portion of the island. No definite locality, 3 July 1931, *Abrams & Wiggins 303* (DS), two small plants shorter than 18 cm determined as "*H. ramosissima* Benth. toward *fascic.*" by D. D. K[eck], 1953; rare, canyon bank, east side, 29 May 1939, *Dunkle 8137* (LAM); east-facing slope, terrace between Cave Canyon and North Peak, 29 April 1969, *B69-84*; southwest of buildings between Landing Cove and Cave Canyon, 21 May 1966, *Philbrick & Benedict B66-369* (MICH, SBBG).

{*Hieracium argutum* Nutt. Reported by Eastwood (1941, p. 73). No other evidence for the occurrence of this genus on Santa Barbara Island is known. The validity of this report is doubtful.}

LASTHENIA CHRYSOSTOMA (F. & M.) Greene (*Baeria hirsutula* Greene of Dunkle, 1940, 1942, 1950; *B. chrysostoma* F. & M.). "*Astragalus traskiae*, *Malacothrix foliosa*, *Hemizonia clementina*, and *Baeria hirsutula* are dominants of the windiest areas" (Dunkle, 1950, p. 274). At least since 1968 *Lasthenia* has produced the most conspicuous patches of spring flowers seen on the island; these have been noted in the Cliff and Cat canyon areas, on North and Signal peaks, and near the north shore between Webster Point and North Peak. Ornduff (Univ. Calif. Publ. Bot. 40:58, 1966) cites a specimen collected by Evermann in 1918. Very succulent, locally abundant, head of Cliff Canyon, 27 April 1968, *Philbrick & McPherson B68-201*; abundant, side of Cliff Canyon, 5 May 1963, *Blakley 5695* (CAS, MICH, RSA, SBBG, SD, US); open north exposure, Landing Cove, 21 March 1940, *Dunkle 7464* (LAM); rocky soil, south high point [Signal Peak], 17 March 1940, *Dunkle 7402* (LAM); forming large yellow areas, north slope of Signal Peak, 4 May 1963, *Blakley 5675* (RSA, SBBG, US); with *Eriogonum*, *Astragalus*, *Trifolium palmeri*, summit area, North Peak, 29 April 1969, *B69-73*; with *Suaeda*, *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Hordeum glaucum*, *Amsinckia intermedia*, north base of Webster Point peninsula, 29 April 1969, *B69-75*; hillside, west end, 18 March 1940, *Dunkle 7412* (LAM). Also seen at East Slope and Arch Point.

MALACOTHRIX FOLIOSA A. Gray [*M. insularis* var. *squalida* (Greene) Ferris of Ferris *In Abrams & Ferris*, *Illus. Flora Pacific States* 4:576, 1960; *M. clevelandii* Gray of Gentry, *Publ. Allan Hancock Pacific*

Exped. 13:40, 1949]. The Trask specimen from Santa Barbara Island is cited by Hall (Univ. Calif. Publ. Bot. 3:266, 1907) with the date "May, 1901". Dunkle (1950, p. 293) accidentally indicated this species as occurring on Santa Catalina rather than Santa Barbara Island. Presently abundant to scattered throughout much of the island. No definite locality, no date. *Trask s.n.* (UC 133516), annotated by H. M. H[all], June 1906, determined by W. S. Davis, 1965; no definite locality, August 1901, *Snodgrass s.n.* (DS 492421), determined as *M. indecora* by W. S. Davis, 1965; no definite locality, 3 July 1931, *Abrams & Wiggins 304* (DS, UC), determined by W. S. Davis, 1965, part determined as "*M. foliosa?* approaching *M. insularis squalida*" by R[oxanna] S. F[erri]; no definite locality, 19 April 1938, *Bilderback s.n.* (SD 21229), determined by W. S. Davis, 1965; no definite locality, 12 August 1938, *Elmore 370* (AHFH), determined by Elizabeth Williams, 1948, much branched plant with small cauline leaves; no definite locality, 14 April 1939, *Bond 372* (SBM), 387 (SBM); no definite locality, 14 May 1940, *Bond s.n.* (UC 637181), determined by W. S. Davis, 1965; with *Coreopsis*, *Amsinckia intermedia*, *Achillea*, *Thelypodium*, *Hordeum glaucum*, east-facing slope, North Peak, 29 April 1969, *B69-67*; dense low-growing mound, bluff due west of mouth of Cliff Canyon, 21 May 1966, *Philbrick & Benedict B66-373*; abundant, gravelly soil, north ridge, 17 March 1940, *Dunkle 7404* (AHFH, LAM); dwarfed by wind, field of spring annuals, head of Cliff Canyon, 30 April 1969, *B69-96*; forming mats on rocky canyon side, Cliff Canyon, 5 May 1963, *Blakley 5696* (MICH, RSA, SBBG); small canyon between Landing Cove and Cliff Canyon, 18 March 1968, *B68-32* (CAS, SBBG), cauline leaves large with wide lobes; small canyon between Landing Cove and Cliff Canyon, 18 March 1968, *B68-33*, cauline leaves small with narrow lobes; infrequent, rocky bluff, east side Landing, 30 May 1939, *Dunkle 8144* (AHFH, LAM), small plants with small cauline leaves; gnawed by rabbits, with *Coreopsis*, *Trifolium palmeri*, cliff of headland just south of Landing Cove, 30 April 1969, *B69-102*; few, north[-facing] slope, base of rocky cliff near center of Cave Canyon, 4 May 1963, *Blakley 5625* (SBBG, SD), determined by W. S. Davis, 1965; erect, variable as to size, loses leaves early, mouth of Middle Canyon, 5 May 1963, *Piehl 63-158* (MICH, SBBG); infrequent, rock bluffs, south end, 28 May 1939, *Dunkle 8105* (AHFH, LAM); scattered, north slope of Signal Peak, 4 May 1963, *Blakley 5677*, determined by W. S. Davis, 1965; common, west side, 27 April 1941, *Moran 824* (DS, UC), determined by W. S. Davis, 1965, determined as *M. insularis* var. *squalida* by [R.S.] Ferris, 1954. Also seen at Cat Canyon and North Peak. *Malacothrix foliosa* is an insular endemic, which also has been collected on Anacapa, San Clemente, and Los Coronados (W. S. Davis, personal communication, 1970). It is similar to certain annual *Malacothrix* of San Miguel, Santa Cruz, and San Nicolas. The Santa Barbara Island plants are extremely variable in habit and foliage characteristics; they are most similar to the popu-

lations from San Clemente Island, the type locality. The achene length is from 1.2 to 1.7 mm, and the mature style extends well beyond the apex of the anthers. This complex, including both *M. foliosa* and *M. indecora*, is currently under further study by W. S. Davis; and his preliminary suggestions have been valuable here.

{*Malacothrix indecora* Greene [*M. foliosa* var. *indecora* (Greene) E. W. Williams]. The *Malacothrix* of Santa Barbara Island has been studied in the field and herbarium; particular attention has been given to the leaf lobing, receptacle, phyllaries, style, and achene. The probable isotypes of Greene's *M. indecora* have been examined (CAS, DS, ND-G). Even though this species is reported from Santa Barbara Island by W. S. Davis (personal communication, 1970), it is presently felt that none of the Santa Barbara Island material seen can be placed in this taxon without reservation.}

MICROSERIS LINEARIFOLIA (Nutt.) Sch.-Bip. [*M. lindleyi* (DC.) A. Gray of some authors]. Not reported by Dunkle or Sumner & Bond. Currently known only from Cave and Middle canyons. North-facing slope, upper Cave Canyon, 27 April 1968, *Philbrick & McPherson B68-216*; with *Silene*, *Rafinesquia*, *Pholistoma a. var. auritum*, north-facing slope, trough of middle-lower Middle Canyon, 22 March 1970, *Philbrick & Benedict B70-49*.

PERITYLE EMORVI Torr. (*P. greenei* Rose). Known only from the eastern portion of the island. With *Mesembryanthemum crystallinum*, *Coreopsis*, *Opuntia prolifera*, *Amblyopappus*, south-facing slope, lower-middle Cliff Canyon, 30 April 1969, *B69-95*; to 8 inches tall, scattered, mouth of Cave Canyon, 4 May 1963, *Blakley 5626* (RSA, SBBG); rocky dry soil, southeast bluffs, 19 March 1940, *Dunkle 7431* (LAM); infrequent, rocky sea bluffs, south end, 28 May 1939, *Dunkle 8104* (LAM). Also seen at Landing Cove and Middle Canyon.

RAFINESQUIA CALIFORNICA Nutt. Not reported by Dunkle or Sumner & Bond. To date found only in lower Middle Canyon. With *Sonchus*, south bank near mouth of Middle Canyon, 5 May 1963, *Piehl 63-157a*; north-facing slope, lower Middle Canyon, 27 April 1968, *Philbrick & McPherson B68-226*.

{*Senecio lyonii* A. Gray. Reported by Gentry (Publ. Allan Hancock Pacific Exped. 13:41, 1949) for "the Channel Islands of San Clemente, Santa Barbara, Santa Cruz". No other evidence for this occurrence on Santa Barbara Island is known; a documenting specimen has not been seen.}

SILYBUM MARIANUM (L.) Gaertn. Not reported by Dunkle or

Sumner & Bond. Found only in Cliff Canyon; and in an attempt to eradicate this introduced weed, all remaining plants were destroyed after each collection was made. Four plants, severe insect damage, bottom of middle-lower Cliff Canyon, 18 March 1968, *B68-20* (SBBG, US); only two plants seen, bottom of middle-lower Cliff Canyon, 15 March 1969, *Philbrick & Ricker B69-48* (RSA, SBBG).

SONCHUS OLERACEUS L. [*S. asper* (L.) Gars. of Sumner & Bond, 1939].

"Common, particularly in regions previously cultivated" (Dunkle, 1940, p. 10). No definite locality, 3 July 1931, *Abrams & Wiggins 297* (DS); dry hillside, 12 August 1938, *Elmore 304* (AHFH); no definite locality, 14 April 1939, *Bond 378* (SBM), as *S. asper*; common, open slopes, east slope, 21 March 1940, *Dunkle 7450* (AHFH, LAM); south-facing slope, lower-middle Cliff Canyon, 15 March 1969, *Philbrick & Ricker B69-50*; scattered, exposed cliffs, Landing Cove, 5 May 1963, *Piehl 63-180*; few, north[-facing] slope, base of small cliff, mouth of Cave Canyon, 4 May 1963, *Blakley 5630* (RSA, SBBG); grazed, infrequent, mouth of Middle Canyon, 5 May 1963, *Piehl 63-160*; common, widespread, open slopes, west side, 29 May 1939, *Dunkle 8131* (LAM). Also seen at Signal Peak and Webster Point.

SONCHUS TENERRIMUS L. Not reported by Dunkle or Sumner & Bond. Currently spreading in the eastern portion of the island. Lower terrace just south of Middle Canyon, 15 March 1969, *Philbrick & Ricker B69-45*, apparently more common than in 1968; terrace east of Signal Peak, between Cat and Graveyard canyons, 19 March 1968, *B68-82* (MICH, SBBG); terrace east of upper Cat Canyon, 28 April 1968, *Philbrick & McPherson B68-247*; north-facing slope near mouth of Cave Canyon, 30 April 1969, *B69-111*. Linear leaf lobes and more rugose achenes distinguish this taxon from the similar *S. oleraceus*.

XANTHIUM SPINOSUM L. Known only from one collection. No definite locality, 3 July 1931, *Abrams & Wiggins 293* (DS).

{*Xanthium strumarium* L. (*X. pennsylvanicum* Wallr.). *Xanthium pennsylvanicum* reported for Santa Barbara Island by Eastwood (1941, p. 74). No other evidence is known; a documenting specimen has not been located.}

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